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TECHNICAL BULLETIN No. 146 FEBRUARY, 1930

TESTING PHYLLOXERA-RESISTANT GRAPE STOCKS IN THE VINIFERA REGIONS OF THE UNITED STATES

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BY

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UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

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INTRODUCTION

During the vintage seasons of 1902 and 1903 the United States Department of Agriculture undertook a careful survey of the grape districts of the Pacific slope (fig. 1) and found that most serious devastating agencies threatened to wipe out the 225,000 acres of table, raisin, and wine grape vineyards. Of these destructive forces the *Phylloxera vitifoliae* (Fitch)and the so-called California vine disease were of prime importance. In southern California from 25,000 to 30,000 acres of vines had been laid waste (pl. 1), and the entire vineyard acreage of the Napa and Sonoma Valleys had been destroyed. In the Santa Clara Valley in 1903 the returns from the vineyards were scarcely one-twelfth of what they had been in 1900, and the vineyards were practically gone. In other bay counties similar conditions were evident, and the rapidity of the damage was appalling. Conservative calculations showed that the loss due to the destruction of vines in this State was at least $1,000 a day. Considering that the entire vinifera region of the United States was interested, and that California alone has an area adapted to grapes equal to almost the whole of France, which was then producing 60 times the quantity

of grapes annually, the magnitude of the interests involved and the importance of aiding the industry—which was still in its infancy—were apparent.

As various means suggested by scientific and practical men had been tried and large sums of money had been expended to safeguard the vineyards with little beneficial result, it was evident that a com-

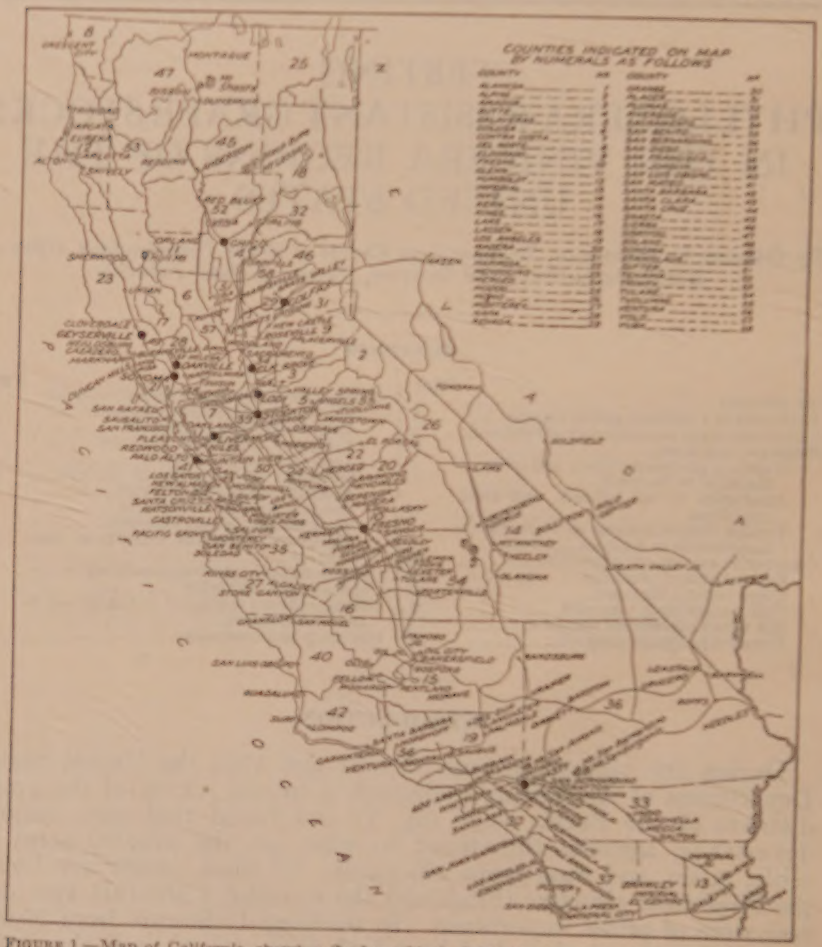


FIGURE 1.—Map of California, showing (by large black dots) the location of the 12 experiment vineyards of the Bureau of Plant Industry

prehensive, systematic investigation of the subject was needed to save the industry from destruction.

A résumé of the viticultural investigations in the vinifera regions of the United States was published in Bureau of Plant Industry Bulletin No. 172[1] and Department of Agriculture Bulletin No. 209,[2] giving data on the investigations and researches made up to 1915. The

[1] HUSMANN, G. C. GRAPE INVESTIGATIONS IN THE VINIFERA REGIONS OF THE UNITED STATES WITH REFERENCE TO RESISTANT STOCKS, DIRECT PRODUCERS, AND VINIFERAS. U. S. Dept. Agr., Bur. Plant Indus. Bul. 172, 86 p., illus. 1910.

[2] HUSMANN, G. C. TESTING GRAPE VARIETIES IN THE VINIFERA REGIONS OF THE UNITED STATES. U. S. Dept. Agr. Bul. 209, 157 p., illus. 1915.

present bulletin supplements the phylloxera-resistant stock researches reported in those bulletins and gives additional data relative to subsequent researches along this line. A few brief statements relative to the phylloxera are important.

PHYLLOXERA IN CALIFORNIA AND IN EUROPE

The phylloxera, which is not native in California, was introduced into that State either from east of the Rocky Mountains, where it is indigenous on wild vines, or from Europe, or possibly from both sources. In 1880 it was found to exist in Sonoma, Napa, Solano, Yolo, Placer, and Eldorado Counties. No careful investigations had been made at that time of much of the regions farther south in the State. It probably existed in Sonoma County as early as 1873, and it is possible that it occurred in the Sonoma Valley and on the Orleans Hills at least 20 years previous to that time.

The insect was probably introduced into Europe on American vines, being taken there about 1858 to 1862, when the destruction of the French vines from oidium was feared. From that period until 1885 it became widely scattered throughout Germany, Switzerland, Austria-Hungary, Italy, Russia, Turkey, and Australia.

Innumerable remedies have been suggested and tried to eradicate the phylloxera from vineyards, but it is conceded that the only way to combat it successfully is to reestablish the vineyards on resistant stocks, except in the case of those that can be flooded cheaply and sufficiently to kill the insects. Locations where this is possible are poor vineyard soils and sites.

EARLY ATTEMPTS AT RECONSTRUCTION OF VINEYARDS

The varying soil (pls. 2, 3, 4, and 5) and climatic conditions in California (Table 3, p. 16) have proved to be a great stumbling block in the reestablishment of the vineyards on resistant stocks. As early as 1876, introductions and plantings of resistant vines were made by some of the more intelligent grape growers. In the winter of 1880–81, several large orders were placed for resistant vine cuttings from east of the Rockies. Some of the earliest introducers from the start were fortunate in procuring resistant varieties well adapted to their locations, conditions, and soils. For instance, below the town of Sonoma (pl. 5, B), near San Francisco Bay, selected riparias introduced from Missouri showed some adaptability to the conditions there and also were congenial to the varieties grafted on them. When this was noted, riparias (pl. 7, D) as a stock were planted indiscriminately in high and low localities and on various soils, particularly in the Nada and Sonoma Valleys (pl. 5, A and B), the vineyards of which were the first to be destroyed by the phylloxera. Unfortunately, in most instances the soil and other conditions were not suited to riparia, and failures predominated.

Then, again, it was claimed that the native grape, *Vitis californica*, was resistant. Without any substantiation of this, by 1883 at least 300,000 of these vines had been planted as grafting stocks. Later their resistance was found to be even less than that of the labruscæ. (Pl. 7, C.)

A few years later it was found that the Lenoir (fig. 2, C) variety did remarkably well in certain locations, and all who could obtain them planted this variety as stocks. However, it was observed that these

were useless on soils not well drained or soils which their roots could not deeply penetrate. It is now known that they are not durable graft bearers.

The rupestris St. George (pl. 7, A) was and is now as indiscriminately planted, and similar and more extensive mistakes are being

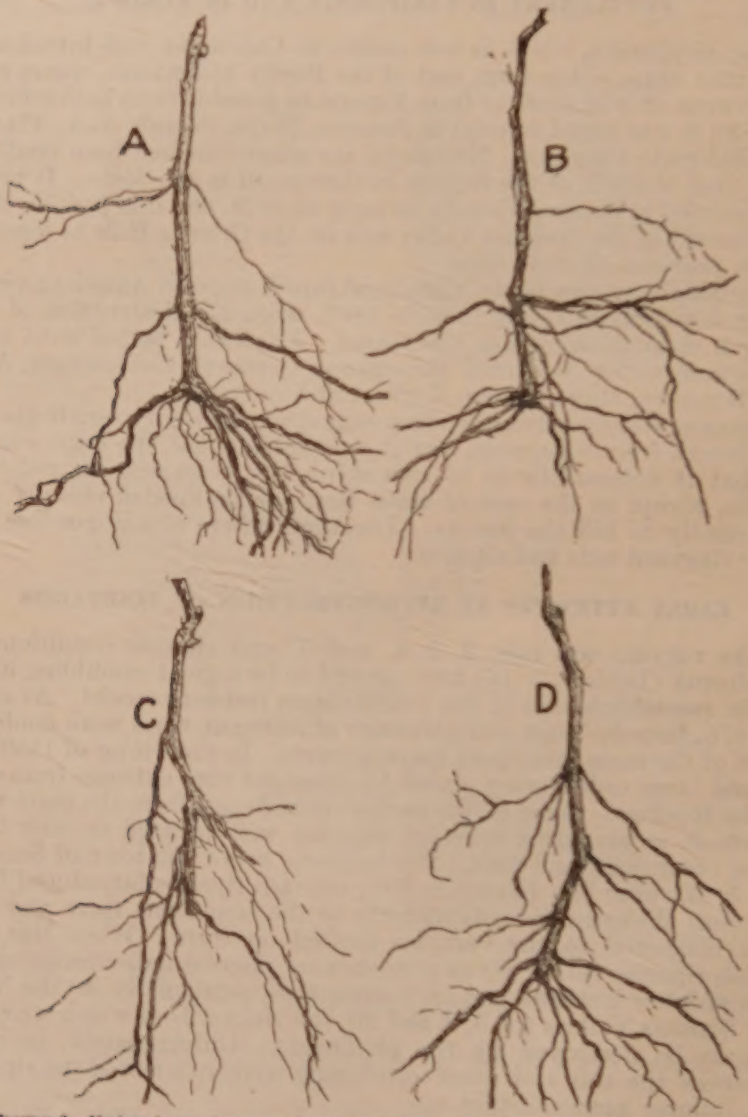


FIGURE 2.—Various types of grape root systems: A, Fleshy type; B, shallow or spreading type; C, deep-striking type; D, oblique type

made with it. It is inadvisable to plant this variety for stock purposes in cool situations on northerly slopes in the coast ranges or to graft it with late-ripening sorts, or to attempt to grow it on shallow, wet, very rich, or stiff clay soils in any locality. It requires deep, permeable soils in the warmer districts and locations.

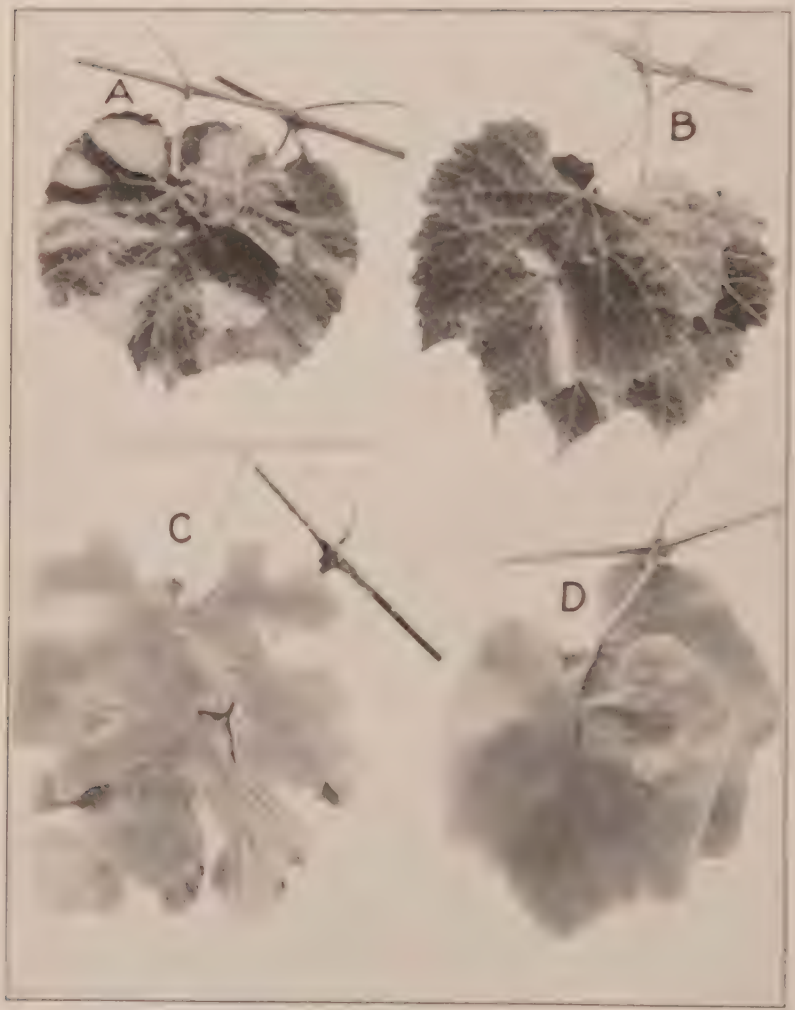
A, Vineyard partly destroyed by *Phylloxera vitifolia;* B, vineyard partly destroyed by California vine diseases; C, vineyard destroyed by diverse agencies

A, Chico Varietal Vineyard; B, Colfax Experiment Vineyard; C, Elk Grove Experiment Vineyard

A, Fresno Experiment Vineyard; B, Geyserville Experiment Vineyard; C, Guasti Experiment Vineyard

A, Livermore Experiment Vineyard; B, Lodi Experiment Vineyard; C, Mountain View Experiment Vineyard

A
B
C



Upper and lower sides of leaves of four native American species of grapes used as stocks: A, *Vitis* [illegible] fourth natural size; D, *V. berlandieri*, one-sixth natural size

The resistant stocks mentioned and all others are good in soils and under conditions to which they are adapted (Tables 1 and 2, pp. 27 and 28), but are less valuable or even worthless where they are not.

FACTORS IN RESISTANCE

The resistance of vines to phylloxera depends upon their inherent resistant character and their adaptation to soil, climatic, and other conditions in which they are to be grown. When used as stocks, their resistance is influenced in direct ratio to the compatibility existing between them and the varieties to which they are to be grafted. Therefore, to establish successfully a vineyard on resistant stocks it is necessary to determine the resistants' adaptation to the soil and conditions where they are to be grown and the compatibility of the varieties it is desired to grow on them.

NATURE OF PHYLLOXERA INJURY AND INHERENT CHARACTER OF THE VINES

Vines of various species, particularly those of American origin and their hybrids, possess varying degrees of resistance to the attacks of phylloxera. Such resistance is manifest in the degree to which the roots of the vines develop the characteristic swellings, nodosities, and tubercles resulting from phylloxera injury, and in the resulting health and vigor of the vine. Those showing no injury in phylloxerated soils are considered resistant. The rate at which those not resistant succumb to the attacks of phylloxera determines the degree of resistance that they possess.

Vines upon the roots of which the phylloxera does not remain or produce injury are said to be immune. The phylloxera usually first punctures the end of one of the youngest roots near the extremity and fixes itself there. Soon thereafter, the swelling or nodosity of the puncture appears. This constitutes the mildest noticeable form of the insect's root injury.

The nodosity is whitish or pinkish and when seen under the microscope somewhat resembles the head and neck of a long-billed bird, and the insect causing it is as a rule found on the throat, or the angle formed where the head joins the neck. The nodosities decay more or less rapidly in the different grape species. In the vinifera they usually rot in a very short time. In the American species the nodosities remain sound for a longer time, the various species differing in this respect. The size of the nodosities on the different species also vary greatly, those on the vinifera being about three times as large as those on the most resistant American species. Between these extremes may be found all intermediate sizes.

The number of nodosities caused by the phylloxera varies greatly on the different varieties. After the formation of a considerable number upon the rootlets, the insects, having multiplied greatly, eventually attack the relatively larger roots. When cancerous patches of decomposition are found on these roots tuberculation occurs and the vine is greatly weakened. Wherever tuberosities are found there are also nodosities, but the reverse is not true. On some grape varieties nodosities may be found on practically all of the rootlets, while on others there may be practically none.

Varieties of some of the American species are not injured by the phylloxera any further than that a few nodosities form on the roots. Such vines have a very high resistance. In fact, the resistant vinings

of the different species are based on a determination of the relative number and size of nodosities found on the roots. In order to indicate somewhat definitely the resistance to phylloxera (not the value of the stock), viticultural scientists have adopted an arbitrary scale of ratings in which the maximum of resistance or immunity is taken as 20, while absence of or no resistance is zero. In accordance with this rating, Viala and Ravaz[1] drew up the following scale of resistance of different species: Rotundifolia, 19; vulpina (pl. 7, D), riparia, rupestris (pl. 7, A), and cordifolia, 18; berlandieri (pl. 6, D) and monticola, 17; cinerea, aestivalis (pl. 7, B), and candicans (pl. 6, C), 15; lincecumii and nova mexicana, 14; bourquiniana, 12; labrusca (pl. 7, C), 5; vinifera, 0. According to this, *Vitis rotundifolia* is rated highest, with 19 points, which for all practical purposes represents absolute resistance, whereas the vinifera show 0, or no resistance.

ADAPTATION TO SOIL, CLIMATE, AND OTHER CONDITIONS

The resistance of a vine to the attacks of the phylloxera without serious injury is influenced greatly by the adaptability of the vine to the climatic (Table 3) and soil conditions (see descriptions of experiment vineyard sites) in which it is grown. These either increase or diminish the vigor of the plant and retard or favor the repairing of the insect injuries. The soil and the climate also affect the resistance by favoring or hindering the approach, dissemination, and activity of the insect. For example, sand of a certain fineness is an obstacle to the insect in going from the surface of the ground to the roots of the vines and from one vine to another.

Climatic differences also affect the multiplication of the insect. Also, a vine variety which in one locality has splendid resistant qualities perishes in another locality having the same soil but a different climate, or in another locality having the same climate but a different soil. This is due not only to the adaptability of some species to moist and others to drier soil and the like, but also to the habit of the root systems of the species (fig. 2), which vary from horizontal to vertical, and to other characteristics of the roots, which vary from thick to thin and from soft to hard, with intermediate grades between these extremes. It will readily be seen how a horizontal-root system would suffer in a dry soil and a hot climate, also what a punishment it would be for a deep-rooting system to be planted in a shallow hard soil or a moisture-loving variety where there is but little moisture.

Congeniality, or the lack of it, existing between vine varieties when grafted on other vine varieties also has its influence on phylloxera resistance. For instance, varieties lacking in congeniality would make a comparatively weak growth and thus succumb more easily to phylloxera attacks. Other causes—and there are many—affect the resistant qualities of vines, and it is with the study of the adaptation of resistant varieties to varying conditions that the researches here reported are concerned. Under favorable conditions of soil and climate a variety will frequently prove more resistant than one that has greater natural resistance but is not adapted to the particular conditions. Thus, the Lenoir in many localities in California on deep loose soils (fig. 2, C) is an excellent resistant as an entire plant and has been largely planted in this and foreign countries for its

[1] Viala, P., and Ravaz, L. American vines (resistant stock); their adaptation, culture, grafting, and propagation. Translated by R. Dubois and E. H. Twight. 299 p., illus. San Francisco. 1903.

own fruit as a direct producer, but investigations[4] show that it should not be used as a graft bearer. Again, the rotundifolia, which of all the species is rated the highest in resistance to phylloxera, is uncongenial to vinifera varieties and therefore valueless as stocks.

The waste of money spent in the reestablishment of vineyards in California from the first appearance of phylloxera to the present time can not even be approximately estimated. Considerable losses of vineyards are likely to occur in the more than 400,000 acres planted in this State during the last 10 years which are not on resistant stocks. That the destruction of California vineyards has been enormous in recent years is evident from the fact that the annual yields of grapes during the last three years are practically the same, although large acreages have been set out each year.

Some of the direct causes of these results are the planting of non-resistants, or of resistants not adapted to the conditions, and grafting on these stocks vinifera unsuitable to them or not suited to the local conditions; the introduction of foreign resistants not true to name; and improper care and management of resistant vineyards, such as allowing roots to grow from vinifera tops grafted on resistant stocks.

Furthermore, in ante bellum days, when labor and production costs were less than half of what they are at the present time, California nurserymen began to furnish growers with resistant stocks and vinifera grafted on such stocks, but they found themselves undersold by foreign nurserymen who were delivering them for slightly more than half the cost of producing them here. Since the introduction of grafted vines is forbidden by the Federal quarantine, California nurseries carry only rupestris St. George, compelling growers who can not obtain other resistant stocks to plant either rupestris St. George or nonresistant vinifera varieties.

FOREIGN DETERMINATIONS AS TO RESISTANCE INAPPLICABLE IN AMERICA

In the portions of the United States where the vinifera varieties are commercially grown, soil, climate, and other conditions differ so much from those of France that it is not often safe to accept the resistance ratings given by French viticulturists to the different varieties. This is very forcibly shown by the experience with riparia varieties so largely used by the French in the past, but which are adapted to few grape localities in California. Also, the French vineyards are so largely located on limy soils that the ability of resistant stocks to endure calcareous conditions has entered much more largely into the varietal ratings than is necessary for stocks in California, making it plain that the resistance standards established by the French can not be accepted as infallible in America or, in fact, serve as more than general guides for American viticultural investigators or viticulturists.

Of the 28 species of grapes native to North America, 14 have been found sufficiently resistant to merit the attention of the viticulturist and have been under test in the experiment vineyards of the United States Department of Agriculture. Table 1 shows their natural habitat, the locations, sites, the type of soil they prefer, the habits of the vines, their root systems, the relative season of leafing, flowering, and ripening of the fruit, the ease or difficulty of propagating them, their suitability for either bench or field grafting, and their relative resistance to phylloxera, cold, dampness, heat, and drought.

[4] Hasmann, G. C. Op. cit.

TABLE 1.—*Cultural data of 11 American species of grapes whose varieties or hybrids are under test as resistant stocks in 11 experiment vineyards in California*

Name and region of nativity	Preferred location	Vine	Roots	Season of ripening	[illegible]	[illegible]	Resistance to—				
							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vitis [illegible]: [illegible] to [illegible]	[illegible]	Vigorous, [illegible]	Large, fleshy	Very late	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
V. [illegible]: [illegible], Texas and New Mexico	[illegible]	[illegible]	[illegible]	Medium early	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V. [illegible]: [illegible]	[illegible]	Vigorous, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
V. [illegible]: Texas	[illegible]	Vigorous, [illegible]	Medium, [illegible]	Do.	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
V. [illegible]: Texas	[illegible]	[illegible]	[illegible]	Do.	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
V. [illegible]: Texas and Mexico	[illegible]	[illegible]	[illegible]	Late	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
V. [illegible]: [illegible] and Arkansas	[illegible]	Vigorous, [illegible]	[illegible]	Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V. [illegible]: Illinois to Texas	Do.	Vigorous, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
V. champini, [illegible] grape: Texas	[illegible]	Vigorous, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

V. [illegible] Texas Panhandle large grape. Texas	Sandy, [illegible]	[illegible] fair grower	[illegible]	Early	25	F...	12	F..	[illegible]	[illegible]	
V. [illegible]	[illegible] Cretaceous, generally rich, sandy, moist, always fresh soils	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
V. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
V. [illegible]	[illegible]	Fair grower	[illegible]	Late	[illegible]	F.	[illegible]	[illegible]		[illegible]	[illegible]

[illegible]

COOPERATIVE EXPERIMENT VINEYARDS

To afford facilities for a comprehensive study and adaptability tests of phylloxera-resistant grape varieties, 12 experiment vineyards have been established in California at different times, one at the United States Plant Introduction Garden near Chico and the others at Colfax, Elk Grove, Fresno, Geyserville, Guasti, Livermore, Lodi, Mountain View, Oakville, Sonoma, and Stockton, in cooperation with growers in these grape-growing centers. These vineyards are located on the leading soil types at different altitudes, at varying distances from the ocean and other bodies of water, and under different climatic and other conditions (fig. 1), a brief description of which follows. The soil descriptions are from data furnished by the Bureau of Chemistry and Soils, and the weather data are taken from records furnished by the San Francisco office of the Weather Bureau and from observations made in the vineyards. Correlation and mechanical analysis of the soils and fuller climatic data are given in Bulletin 172 of the Bureau of Plant Industry.[5]

Attention is called to the fact that each of the aforementioned experiment vineyards[6] was located on land just cleared of phylloxera-infested vines, so that these sites and vineyards adjacent to them were full of phylloxera. Furthermore, in the Fresno and Oakville experiment vineyards (the plantings in these two vineyards conjointly including all the so-called phylloxera-resistant stock varieties that the department has had under test) the roots of the vines were annually inoculated with phylloxera to make absolutely certain that they were enabled to resist the attacks of this insect under the various climatic, soil, and other conditions found in the different experiment vineyard locations.

GENERAL PLAN OF PLANTINGS[7]

In the Chico varietal vineyard only 2 vines of each variety have been planted, whereas in all the other vineyards the plantings, for comparative tests and study, were made in regular checks of 10 vines of each variety except in instances where nothing definite was known of a variety, and plantings of a less number (usually 3 vines of a variety) were made for a preliminary study. Each vine received its block, row, and vine number. A complete history and accurate records were kept from the time of planting. Their behavior was closely noted, detailed descriptions were made of the vines, and their value and adaptability to different conditions recorded.

CHICO VARIETAL VINEYARD

The Chico varietal vineyard is located at the United States Plant Introduction Garden. (Pl. 2, A.) The alluvial soil, composed of material brought down from the mountains and hills on the east, is 8 to 12 feet deep and is underlain by a body of sandy waterworn gravel and bowlders, which always carry water. The soil is of light texture, varying from a light loam to heavy, fine sandy loam, the

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[5] HUSMANN, G. C. 1910. Op. cit.

[6] Acknow[illegible] U. S. Department [illegible]ture.

[7] [illegible] Husmann, [illegible]

heaviest being loam. It is well drained and easily cultivated. The heavy, fine sandy loam consists of 30 to 40 inches of fine sandy loam, underlain by very fine sandy loam, usually containing some gravel. The light loam has 10 to 15 inches of fine sandy loam underlain by a heavier structure closely approaching loam. The largest area of this soil is found about Chico, but similar soil occurs in the Feather and Bear River Valleys.

At the Chico vineyard are being assembled and maintained two plants each of grape varieties that prove of special value for specific purposes, together with grape immigrants from all parts of the world introduced by the Office of Foreign Plant Introduction.

COLFAX EXPERIMENT VINEYARD

The Colfax experiment vineyard was established on the property of Louis Cortopassi in the Sierra Nevada Mountains. (Pl. 2, B.)

The soil, which is usually fairly deep, well drained, and hilly, originated in the decomposition of the Mariposa formation, consisting of dark shales or slates, sandstone or quartzite sandstones, and conglomerates. The large proportion of iron present from decomposing volcanic-rock material when exposed to perfect weathering gives the soil a deep red color. Dark, shallow, conglomerate rocks sometimes outcrop in spots, and rock fragments occur. The first few inches are often dark red, from the accumulation of organic matter. The first 8 to 18 inches are usually brownish red clay or clay loam, underlain by 3 to 6 feet of red clay or clay loam, with partially decomposed and weathered-rock formation, giving the soil a yellow appearance. Rock outcrops of conglomerates, chert, and slate occur in the higher portions.

The native vegetation is manzanita, chaparral, live oak, and yellow pine. The Colfax district is unique in the diversity of fruits grown on sidehill locations.

ELK GROVE EXPERIMENT VINEYARD

The Elk Grove experiment vineyard is on the property of the Colonial Grape Products Co. in the Sacramento Valley plain. (Pl. 2, C.) This plain is gently undulating, with frequent low mounds and intervening depressions commonly called hog wallows and occasional larger but locally inclosed basinlike depressions. Surface drainage is moderately well developed. The occurrence of compact heavy subsoils is usually accompanied by indurated or cemented substrata or layers of hardpan. Subdrainage is restricted, which during and immediately following the winter rainy seasons renders the soil cold, wet, and boggy, with water standing in the depressions.

The soil of this vineyard tract strongly resembles both the San Joaquin and the Madera series. The surface is Madera loam—clay loam of dark-brown to light reddish or sometimes yellowish brown color—9 to 18 inches in depth and is friable when in favorable condition of moisture. The subsoil, occurring 9 to 18 inches below the surface, varies from 7 to 13 inches in depth and is a heavy, compact, semicemented, dark to yellow-brown clay, grading to hardpan. Underneath the subsoil is a hard stratum of hardpan. The soil and subsoil material are retentive of moisture and under favorable conditions of drainage, irrigation, cultivation, and depth to hardpan are well adapted to vine culture.

FRESNO EXPERIMENT VINEYARD

The United States Experiment Vineyard near Fresno, Calif., (pl. 3, A) was established on the property of the Fresno Vineyard Co. The soil is the San Joaquin sandy loam. The fact that it is an outlying isolated portion of soil of this character accounts for the increased depths to hardpan and the sandier subsoil immediately above. The San Joaquin sandy loams are confined to lands adjacent to the lower foothills on the eastern side of the San Joaquin and Sacramento Valleys, where 75,000 acres near Fresno, 6,000 acres near Stockton, and 265,000 acres in the vicinity of Sacramento have already been mapped. The soil is light red in color, granitic in origin, and composed largely of sharp, angular particles. The surface is rolling and generally covered with hog wallows and small mounds.

In this plot two varieties of soil were recognized, namely, an adhesive sandy loam, closely approaching a true loam, and a friable sandy loam. The former retains moisture longer than the latter, which is a deeper soil of lighter texture. In leveling the plot the natural soil conditions were disturbed, the depth of the sticky adhesive sandy loam was decreased in spots, and free sandy loam was exposed in other places, causing the hardpan underlying the plot to occur at depths varying from scarcely 20 inches to more than 6 feet, whereas the average depth is 3½ to 4 feet below the surface. This hardpan, which always accompanies San Joaquin sandy loam soil, is a red iron-sandstone substance cemented by hydrates of iron and alumina combined with clay. When this occurs at 2 feet or less below the surface, blasting is necessary. Trees and vines thrive when the hardpan is broken or where it lies at a sufficient depth below the surface.

The soil of the plot above the hardpan contains alkali varying from less than 0.05 to more than 20 per cent; in the lowest grade soil, however, no alkali is visible. Of the salts, about 2 per cent are potassium and more than 90 per cent are chlorides, about as follows: Calcium, 50; magnesium, 25; sodium, 15. The remainder consists of calcium sulphate and bicarbonate of soda. The depth of the water table on the tract averages 8 feet.

This is the second in importance of the experiment vineyards of the United States Department of Agriculture. It was purchased by the Federal Government in 1923, since which time it has become important as a place for viticultural research.

GEYSERVILLE EXPERIMENT VINEYARD

The Geyserville experiment vineyard was established on the property of John D. Bosch. (Pl. 3, B.) The soil consists of a uniform dark gravelly loam to a depth of 2½ to 3 feet with a subsoil of light or yellowish brown color, similar in texture to the topsoil. The soil is very mellow and carries considerable humus, which enables it to retain moisture well. This type of soil extends over considerable areas along the streams and the floor of the Sonoma Valley, having been washed from the shale, schist, and conglomerate hills. Soils of this type produce some of the choicest red and white grape juices of the State.

GUASTI EXPERIMENT VINEYARD

The Guasti experiment vineyard, in the San Bernardino Desert, was established on the property of the Italian Vineyard Co. (Pl. 3, C.)

The soil, mapped as Maricopa gravelly sand and washed from the Sierra Madres, is a gray-brown gravelly sand of a texture uniform to an unknown depth. The surface is compact when untilled, because the sharp angular sand in its composition becomes somewhat cemented by the organic matter occurring in the topsoil. At a depth of 2 feet it is more concentrated and often yellowish from the oxidation of iron. It is almost entirely granitic and contains quantities of unfermented potash and feldspar particles, which would indicate that there would be abundant potash for the maturing of grapes. It covers most of the San Bernardino Valley floor and when thoroughly cultivated holds moisture well, the fine sand and silt giving the capillary power to bring water up from below. Two of the largest vineyards of the world are in this valley, on similar soil. As the phylloxera was not known to exist there, the plantings in this experiment vineyard were principally vinifera varieties. However, phylloxera-resistant stocks were included in the tests, to supply information relative to the adaptability of such stocks to that section.

LIVERMORE EXPERIMENT VINEYARD

The Livermore experiment vineyard was established on the property of C. H. Wente. (Pl. 4, A.) The vineyard has a very uniform, level, alluvial soil, derived from decomposed shales and schists, and is full of rounded gravel washed down from the surrounding mountains. The surface soil is a dark-brown gravelly loam; the second, third, and fourth feet are gravelly sandy loam, replaced by gravelly sand in the fifth foot. The humus decreases with the depth, while the gravel increases, varying from 30 to 50 per cent. The proportion of clay is greater than that of silt, which gives the soil a very heavy appearance, the gravel sticking together very tightly when dry or packed. There is no alkali in the soil, but ground water is encountered at a depth of 5 or 6 feet in some places. These soils are common over the Livermore Valley, and grapes grown on them produce a superior white juice of the sauterne type.

LODI EXPERIMENT VINEYARD

The Lodi experiment vineyard was established on the Lawrence & Murray property. (Pl. 4, B.) A large body of this soil exists between Lodi and Acampo.

There are two variations in the plot. Phase No. 1 is a brown, free, sandy loam, underlain below 4½ feet by a more adhesive light-brown or yellowish sandy loam. Occasional iron concretions give the subsoil a mottled color. The soil has good capillarity, and the water table occurs at 5 to 6 feet. Phase No. 2, an adhesive sand, was formed by an old stream channel. This is light-brown sand to a depth of 3 feet, the subsoil water-washed sand, much looser in texture and lighter in color, and dry to a depth of more than 6 feet, as the soil texture is too loose to exert much capillary force. There is no hardpan or alkali. The soils, however, are deficient in lime, but otherwise they are very productive, comparatively level, unirrigated, and easily tilled. This locality is well known for its table grapes and as a table-grape shipping point.

MOUNTAIN VIEW EXPERIMENT VINEYARD

The Mountain View experiment vineyard was established on the property of Mrs. Caroline Duttel, on the west side of the Santa Clara Valley. (Pl. 4, C.)

The soil is a gravelly Placentia sandy loam. The first 12 inches are gravelly sandy loam, dark brown from humus, below this, to a depth of 4 feet, the subsoil becomes redder and more gravelly until sand is encountered. It is well drained, but inclined to become too dry in summer and fall. The surface soil at times becomes quite compact and when plowed breaks up into hard clods. When tilled at the right time it works into a very mellow condition. These soils are from washings of granitic sandy shales and adjacent rocks.

Before the destruction of vineyards by phylloxera and other agencies, the Santa Clara Valley was the banner wine-producing section of California.

The following areas of Placentia sandy loam have been surveyed in California: San Jose, 61,500; Lower Salinas, 74,000; Los Angeles, 66,000; San Bernardino, 87,000; San Gabriel, 48,000; and Santa Ana, 16,800 acres. Soils of this series occur throughout the Coast Range of mountains from San Francisco to the Mexican line, occupying undulating portions of valleys close to the hills.

OAKVILLE EXPERIMENT VINEYARD

The United States Experiment Vineyard near Oakville, Calif. (pl. 5, A) was established on the property of the To-Kalon Vineyard Co. The soil is a dark-brown or black gravelly clay or heavy loam, containing a large quantity of organic matter formed in a swamp or lagoon extending in past geological ages up Napa Valley from San Pablo Bay, typical of the greater part of the soils in the valley floor. On weathering, the shales, sandstones, limestones, lime conglomerates, and large quantities of gravel with little erosion of edges are washed down from the steep hills or mountains surrounding Napa Valley and tend to form a heavy or clayey soil with only small quantities of sand. No hardpan or alkali appears. The surface is undulating, affording a fairly rapid run-off of surplus rain water, although in places the subsoil is somewhat wet during the spring months. No irrigation is necessary. The clay and silt in the subsoils greatly aid in retaining moisture in spite of the 20 to 40 per cent of gravel that they contain. Cultivation reduces the surface to a good mulch.

When grape culture in Napa Valley and the adjoining foothills became an important industry, a reputation for the superior qualities of Napa County wines, especially its white wines, was rapidly made, and it has remained one of the leading juice-grape sections of the State.

This property was purchased by the Federal Government in 1923, since which time it has rapidly become the most important experiment vineyard of the United States Department of Agriculture for viticultural research.

SONOMA EXPERIMENT VINEYARD

The Sonoma experiment vineyard was established on the property of the Gundlach-Bundschu Wine Co. (Pl. 5, B.) The soil is of rather poor quality. To a depth of 8 or 10 inches it is a gray loam, more easily tilled than its texture indicates. The subsoil is clay to a depth of 6 feet, showing at 4 feet an increase of sand, from light brown to a

yellowish brown in color. The soil is found near where the weathered shales from the surrounding hills have been partially broken down and transported into the valleys, where they decompose. The soil usually occupies small undulating ridges or elevations and is surrounded by the dark-brown alluvial clay loam of the valley floor. The surface drainage is good, and alkali is not present in injurious quantities. This soil occurs over extensive areas in the Sonoma Valley and in the adjacent bay regions and produces superior white juices of the Riesling, Chasselas, and Traminer types.

STOCKTON EXPERIMENT VINEYARD

The Stockton experiment vineyard was established on the property of the San Joaquin Valley Realty Co., on Stockton clay-loam adobe. (Pl. 5, C.) This type of soil, locally known as black adobe, was laid down in a swamp or tidal marsh in quiet water, the decomposing vegetation giving it a black color. It is a clay loam in texture, adhesive and sticky when wet and very hard when dry, cracking into large cubical blocks full of small cubical fractures. Sufficient rain makes the clods readily. If cultivated when neither too wet nor too dry, the soil is friable and pulverizes well. The subsoil is a light-yellow silt loam, usually separated from the surface soil at a depth of 2½ feet by a thin stratum about one-half inch in thickness, of rather soft marly or calcareous hardpan, which is not always continuous and is often broken or disintegrated. Roots and water readily penetrate the subsoil, often passing through the hardpan. The depth to the water table varies from 3½ to 6 feet in wet seasons and from 8 to 10 feet in dry ones. This variation is influenced by a thin, marly hardpan, which appears to hold the water down under pressure.

It is somewhat difficult to establish vineyards on these soils, but when successful they are very productive and lasting. Grapes for diverse purposes are grown on them. One of the largest grape-juice establishments in the world is located near Stockton, and heavy shipments of table grapes grown on these soils are made. Soils of this type in California have been mapped as follows: Stockton, 53,232 acres; Hanford, 5,470 acres; Fresno, 5,664 acres. This soil covers many thousand acres between the Marysville Buttes and about North Durham in the Sacramento Valley.

DATA CONCERNING THE EXPERIMENT VINEYARDS

Data concerning the 12 experiment vineyards are given in Tables 2 and 3.

TABLE 2.—*Location of the 12 experiment vineyards of the Bureau of Plant Industry in California, their elevation, year established, number of seasons vines were cultivated in each, and year when discontinued*

Location of vineyard	[illegible]	[illegible]	[illegible]	[illegible]
Chico, Butte Co., 4 miles south of town	[illegible]	[illegible]	[illegible]	[illegible]
Colfax, Placer Co., 1½ miles southwest	[illegible]	[illegible]	[illegible]	[illegible]
Elk Grove, Sacramento Co., [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fresno, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Geyserville, Sonoma Co. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville, Napa Co. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 3.—*Temperature and rainfall at the 12 experiment vineyards of the Bureau of Plant Industry in California*

MAXIMUM TEMPERATURE (° F.)

Vineyard	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Chico	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colfax	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elk Grove	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fresno	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Geyserville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Livermore	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lodi	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mountain View	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sacramento	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stockton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MAXIMUM TEMPERATURE (° F.)

Vineyard	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Chico	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colfax	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elk Grove	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fresno	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Geyserville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Livermore	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lodi	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mountain View	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sacramento	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stockton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MAXIMUM TEMPERATURE (° F.)

Vineyard	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Chico	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colfax	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elk Grove	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fresno	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Geyserville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Livermore	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lodi	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mountain View	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oakville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sacramento	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stockton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] The maximum and minimum temperatures given in this column are the highest and lowest during the entire period.

TABLE 3.—*Temperature and rainfall at the 12 experiment vineyards of the Bureau of Plant Industry in California*—Continued

PRECIPITATION (INCHES)[1]

Vineyard	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
[illegible]	6.41	3.77	5.[illegible]	1.14	0.[illegible]	0.39	T	0.01	1.[illegible]	0.[illegible]	2.[illegible]	1.[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3.46	2.[illegible]	2.[illegible]	1.47	.78	.13	.02	.01	.[illegible]	.[illegible]	1.[illegible]	1.[illegible]	19.[illegible]
[illegible]	2.11	1.30	2.24	.77	.[illegible]	.03	.001	T	.[illegible]	.[illegible]	.77	1.[illegible]	[illegible]
[illegible]	11.0[illegible]	6.45	9.49	1.60	1.30	.45	T	T	.[illegible]	1.[illegible]	2.[illegible]	1.24	[illegible]
[illegible]	6.06	4.30	6.40	1.[illegible]	.[illegible]	.17	.02	.01	.64	.[illegible]	.[illegible]	1.[illegible]	[illegible]
[illegible]	4.55	2.00	3.73	.63	.57	.19	T	.03	.21	.63	.[illegible]	2.[illegible]	[illegible]
[illegible]	5.02	2.[illegible]	4.71	.[illegible]	1.[illegible]	.26	T	.003	.40	.53	1.14	2.[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5.07	4.43	6.57	1.10	.78	.[illegible]	T	.01	.[illegible]	.77	2.10	1.[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4.24	2.12	3.62	.73	.[illegible]	.14	T	.01	.[illegible]	.[illegible]	.[illegible]	2.[illegible]	15.[illegible]

[1] T=Trace.

GROWTH RATINGS OF PHYLLOXERA-RESISTANT STOCKS

In Table 4 (in which the parentage follows the name if the varietal designation does not give it), the upper numbers after each name in the column headed "Experiment vineyard" show the years when the vines were planted, and the lower numbers show the growth ratings, which in all cases were made in the fall of 1920, except that those at Mountain View were made in 1912 and those at Livermore in 1914. Growth ratings later than 1920 were not secured for these vineyards, which were discontinued that year.

TABLE 4.—*Tests of Phylloxera-resistant grape stocks in the 12 experiment vineyards in California, showing the number of years since vines were planted and their relative growth ratings*

Variety	Experiment vineyard											
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	13	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	13		[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	
Growth rating	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	
[illegible]												
Years planted	13	13	[illegible]	[illegible]						[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	13		[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
Growth rating	[illegible]		[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
[illegible]												
Years planted			[illegible]	[illegible]						[illegible]		[illegible]
Growth rating			[illegible]	[illegible]						[illegible]		[illegible]

TABLE 4.—*Tests of Phylloxera-resistant grape stocks in the 12 experiment vineyards in California, showing the number of years since vines were planted and their relative growth ratings*—Continued

Variety	Experiment vineyard											
Aramon × rupestris Ganzin, No. 1:												
Years planted	13	14	20	17	20	---	10	16	4	12	13	12
Growth rating	100	100	90+	90+	90-	---	90	80-	85	85	85	60-
Aramon × rupestris Ganzin, No. 2:												
Years planted	13	14	20	17	20	12	10	16	4	12	13	13
Growth rating	95	100+	90+	90	90	90+	85	80+	90	90	90-	75-
Aramon × rupestris Ganzin, No. 3:												
Years planted	3		7	17	20	---	10	----	4	12	13	13
Growth rating	90		90+	90	90	---	90	----	90	90	90+	90-
Aramon × Phoenix (Vitis arizonica):												
Years planted	3		7			12						----
Growth rating	90		60			90						----
Aramon × V. [illegible]:												
Years planted	14	14	20	17	20		10		4	12	13	13
Growth rating	100	80	90+	90+	90		90		90	90+	90+	90
Berlandieri × vinifera (1):												
Years planted	14	14	20	17		4	10		4	12		13
Growth rating	100	80	60	80		90	80		90	90		90+
Berlandieri, No. 1:												
Years planted	14	14	20	17	20		10	16	4	12	13	
Growth rating	100	100	90+	90	90		90	90	90	90+	90+	
Berlandieri, No. 2:												
Years planted	14	14	20	17	20					12		
Growth rating	90+	80+	70+	90+	90					70		
Berlandieri, No. 9:												
Years planted	14		20	17	20		7		3	10	10	----
Growth rating	90		70+	90+	90		80	----	70	80	80	----
Berlandieri × riparia, No. 33 E. M.:												
Years planted	13	14	20	17				16	4	12		13
Growth rating	100	90	80	90+				75+	90	90		80
Berlandieri × riparia, No. 34 E. M.:												
Years planted	14	14	20	17	20		7	---	4	12	10	13
Growth rating	90	90+	80	90	90		80	---	80	90-	80-	90+
Berlandieri × riparia, No. 157 41:												
Years planted	13	14	20	17	20			16	4	12		13
Growth rating	100	100+	80+	90+	90+	----	----	90+	90	92	----	90+
Berlandieri × riparia, No. 420 A:												
Years planted	13	14	20	17	20	4	10	16	4	12	13	13
Growth rating	100+	90	90+	90	90+	90+	90	90	90	90-	90	90-
Berlandieri × riparia, No. 420 B:												
Years planted	3	14	20	17		4	7	16	4	12		
Growth rating	80+	90	90+	90+		90	90+	90+	90	90		
Riparia × rupestris (Vitis [illegible] No. 601):												
Years planted	4		7	17	20		4					
Growth rating	90		90+	90	90		90					
Vialla × [illegible], No. 106 (V. M.):												
Years planted	14		20	17			10	16	4	12		
Growth rating	100		90+	90+			90	90	90	90+		
Vialla × [illegible], No. E. A.:												
Years planted				17	20	12	10		4	12	12	
Growth rating	90+			90	90	90+	90		90	90+	90	
Vialla × [illegible], No. E. H.:												
Years planted	3			17	20				4	12	12	13
Growth rating	90+			90+	90+	----	----	----	90	90+	90	90-
Vialla × [illegible], No. [illegible]:												
Years planted	14		20	17								12
Growth rating	90		80	80						90+		60-
Vialla × [illegible], No. 2003:												
Years planted	14			17			7		4	12	12	13
Growth rating	90			90+			90		90	90	90+	85
Vialla × [illegible]:												
Years planted							7			12	12	----
Growth rating							90			90	90	
Vialla × [illegible], No. 1204:												
Years planted	3		7	17			7			12	12	
Growth rating	80		80	90+			80			90+	90+	

TABLE 4.—*Tests of Phylloxera-resistant grape stocks in the 12 experiment vineyards in California, showing the number of years stocks were planted and their relative growth ratings*—Continued

Variety	Experiment vineyard											
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	14	6	11				[illegible]		[illegible]			
Growth rating	[illegible]	[illegible]	[illegible]				[illegible]		[illegible]			
De Grasset (V. champini)												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
Dog Ridge (V. champini)												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	
Growth rating	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
[illegible]												
Years planted	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13
Growth rating	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66–
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66–
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]			[illegible]		[illegible]		[illegible]	[illegible]		
Growth rating	[illegible]	[illegible]			[illegible]		[illegible]		[illegible]	[illegible]		
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			18	[illegible]	
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]+	[illegible]	
[illegible]												
Years planted	[illegible]			[illegible]						16	[illegible]	[illegible]
Growth rating	[illegible]			[illegible]						73–	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]–	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]		[illegible]		[illegible]				[illegible]		
Growth rating	[illegible]	[illegible]		[illegible]		[illegible]				[illegible]		
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		
[illegible]												
Years planted	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Growth rating	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]												
Years planted	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
Growth rating	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
[illegible]												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
Years planted	[illegible]		[illegible]	[illegible]						[illegible]	[illegible]	
Growth rating	[illegible]		[illegible]	[illegible]						[illegible]	[illegible]	

TABLE 4.—*Years of Phylloxera resistance grape stocks in the 13 experiment vineyards in California, showing the number of years since vines were planted and their relative growth ratings*—Continued

Variety	Davis	Fresno	Kearney Ave.	Fresno	Oakdale	Oakdale	Lodi	Manteca	Lodi	Lodi	Stockton
Riparia Martinez											
Years planted	14										
Growth rating	100										
Riparia Rupestris											
Years planted	8										
Growth rating	62+										
Riparia Selected											
Years planted											
Growth rating											
Riparia Selected, No. 101-14											
Years planted	14	13	6								
Growth rating	100	92—	90—								
Riparia×(cordifolia×rupestris), No. 108-8											
Years planted	14	14	8								
Growth rating	60—	90—	90—								
Riparia Grand Glabre×Aramon rupestris, No. 4110:											
Years planted	14			18			10	10		10	10
Growth rating	90+			92+			92	90		90	92—
Riparia [illegible] No. 101											
Years planted	14	14	8								
Growth rating	90+	92—	92—								
Riparia [illegible] No. 101-14:											
Years planted	14	14	8								
Growth rating	90	90—	92+								
Riparia×rupestris, No. 108-103:											
Years planted	8	14	8		4					8	8
Growth rating	90+	98+	92+		90					90—	90—
Riparia×rupestris, No. 3306:											
Years planted	14	14	8	18							
Growth rating	90+	90	90—	90	92	90+	90	90—	90	90+	90+
Riparia×rupestris, No. 3309:											
Years planted	14	14	8	18							
Growth rating	90	90	90	90+	90—	90+	90	90—	90	90	90
Riparia×rupestris de Jaeger:											
Years planted	14	14		18		12				10	10
Growth rating	90+	90—		90		90+				90+	90
Riparia × (rupestris×Aramon) Jaeger, No. 201:											
Years planted	14	14									
Growth rating	100	90—		90	90	90+	90	90+	90	90	90+
Riparia×rupestris Ramond:											
Years planted	14										
Growth rating	92+										
Rupestris des Causettes:											
Years planted	14	14	6	17	16	14	10	10	8	17	16
Growth rating	90—	90—	92+	90—	92	90+	90	90—	90	90—	90—
Rupestris des Semis, No. 81-2:											
Years planted	13	14	7	17			7		7	17	17
Growth rating	90	90—	90—	90+			90		90	90—	90—
Rupestris [illegible]											
Years planted	14		6							14	
Growth rating	90+		90+							92+	
Rupestris Le Isere											
Years planted	14		8			14				14	
Growth rating	85+		90+			90+				90—	
Rupestris Martin											
Years planted	14	13		17	16	14	10	10	8	17	16
Growth rating	92+	85+		75—	92—	80	80	80	75	85	90+
Rupestris Metallica											
Years planted	14	14	6	17	16	13	10	10	8	17	14
Growth rating	100	80—	85—	80—	90+	90	90	90+	80	90+	70—
Rupestris Missouri											
Years planted	14	13	6	16	15		10		8	17	16
Growth rating	90	80—	92+	80—	90+		90		74	90+	82+
Rupestris [illegible]											
Years planted	14		6	16			7			16	
Growth rating	90+		92	75+			80			80—	

Variety	Stockton	Stockton	Stockton	Stockton	Stockton	Stockton	Stockton	Stockton	Stockton	Stockton	Stockton
Riparia Martinez											
Years planted											
Growth rating											
Riparia Rupestris											
Years planted											
Growth rating											
Riparia Selected											
Years planted											
Growth rating											
Riparia Selected, No. 101-14											
Years planted											
Growth rating											
Riparia×(cordifolia×rupestris), No. 108-8											
Years planted											
Growth rating											
Riparia Grand Glabre×Aramon rupestris, No. 4110:											
Years planted											
Growth rating											
Riparia [illegible] No. 101											
Years planted											
Growth rating											
Riparia [illegible] No. 101-14:											
Years planted											
Growth rating											
Riparia×rupestris, No. 108-103:											
Years planted											
Growth rating											
Riparia×rupestris, No. 3306:											
Years planted											
Growth rating											
Riparia×rupestris, No. 3309:											
Years planted											
Growth rating											
Riparia×rupestris de Jaeger:											
Years planted											
Growth rating											
Riparia × (rupestris×Aramon) Jaeger, No. 201:											
Years planted											
Growth rating											
Riparia×rupestris Ramond:											
Years planted											
Growth rating											
Rupestris des Causettes:											
Years planted											
Growth rating											
Rupestris des Semis, No. 81-2:											
Years planted											
Growth rating											
Rupestris [illegible]											
Years planted											
Growth rating											
Rupestris Le Isere											
Years planted											
Growth rating											
Rupestris Martin											
Years planted											
Growth rating											
Rupestris Metallica											
Years planted											
Growth rating											
Rupestris Missouri											
Years planted											
Growth rating											
Rupestris [illegible]											
Years planted											
Growth rating											

TABLE 4.—*Tests of Phylloxera-resistant grape stocks in the 12 experiment vineyards in California, showing the number of years since vines were planted and their related growth ratings*—Continued

Variety	Experiment vineyard											
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	—	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]			[illegible]				[illegible]			
Growth rating	[illegible]	[illegible]			[illegible]				[illegible]			
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]		
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]		
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]							[illegible]		
Growth rating	[illegible]	[illegible]	[illegible]							[illegible]		
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]		[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]		[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	[illegible]	
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	[illegible]	
Rupestris × [illegible]:												
Years planted	[illegible]	[illegible]		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible] × rupestris, No. [illegible]):												
Years planted		[illegible]		[illegible]	[illegible]		[illegible]				[illegible]	
Growth rating		[illegible]		[illegible]	[illegible]		[illegible]				[illegible]	
[illegible]:												
Years planted	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Growth rating	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]:												
Years planted	[illegible]						[illegible]					
Growth rating	[illegible]						[illegible]					
[illegible]:												
Years planted	[illegible]				[illegible]		[illegible]			[illegible]	[illegible]	
Growth rating	[illegible]				[illegible]		[illegible]			[illegible]	[illegible]	
[illegible]:												
Years planted	[illegible]		[illegible]	[illegible]						[illegible]	[illegible]	
Growth rating	[illegible]		[illegible]	[illegible]						[illegible]	[illegible]	
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]		[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]		[illegible]
[illegible]:												
Years planted			[illegible]	[illegible]								[illegible]
Growth rating			[illegible]	[illegible]								[illegible]
Solonis Robusta:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]			[illegible]		
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]			[illegible]		
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]:												
Years planted	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rating	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 4.—*Tests of Phylloxera-resistant grape stocks in the 12 experiment vineyards in California, showing the number of years since vines were planted and their relative growth ratings*—Continued

Variety	Experiment vineyard											
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The growth or adaptability of each variety at each vineyard where it is under test is expressed in the form of a percentage rating on a scale in which the growth of the variety under conditions to which it is well adapted is taken as the standard of excellence, 100 per cent.

Therefore, these adaptability ratings represent the behavior of each variety under the conditions existing at the several vineyards expressed in terms that permit comparison with its behavior elsewhere. They are not based on a comparison with other varieties in the same vineyard. Each variety is therefore rated on a scale based on its own standard of excellence, rather than on an arbitrary scale formulated for application to all varieties. It is believed that this method renders a truer expression of the reaction of each variety to different soil and climatic conditions than would be possible were an arbitrary scale of growth measurement used.

To illustrate, Aramon × rupestris Ganzin, No. 1, planted at each of three experiment vineyards in 1904, at Oakville was rated 100, at Livermore 85, and at Lodi only 60. This shows that at Oakville the growth was most satisfactory and was therefore rated 100; at Livermore the growth was good but not nearly so good as at Oakville and was rated at 85; at Lodi it made a poor growth, which as compared with the perfect growth made at Oakville was as 60 to 100, i. e., 60 per cent.

The minus sign after a rating indicates that in previous years the vines had much higher rating but are steadily on the decline, whereas

the plus sign shows they formerly had lower ratings which improved as the vines matured. Where no sign occurs such ratings were constant. This shows that some vine varieties start into growth and develop rapidly but speedily prove worthless; others take hold and develop slowly at first, but later prove most valuable as sturdy, safe, and constant vine varieties. Resistance to the phylloxera is, of course, an all-important consideration, and while these ratings may serve as a fairly safe guide in the selection of resistant stocks, nevertheless the writer wishes to stress the fact that these tests have been under way only 20 years, and there have been many instances in California where viniferas on their own roots under very favorable conditions have resisted phylloxera for an even longer time.

A number of the resistant-stock varieties have been growing a sufficient time to show what may be expected of them under similar conditions. In the following list of stocks worthy of special mention for having made excellent growth ratings at each of the 12 California experiment vineyards, the varieties are given in the order of their ratings, beginning with the best growers:

Ceres Varietal Vineyard.—Aramon × rupestris Ganzin, No. 1; Constantia; Dog Ridge (champini); (aestivalis × monticola) × (riparia × rupestris), No. 554-5; Lenoir; monticola × riparia, No. 18815; Salt Creek; australis (Jaeger); riparia × berlandieri, No. 161-49; Mourvedre × rupestris, No. 1202; Solonis × Othello, No. 1613; rupestris St. George; rupestris Pillans.

Colfax Experiment Vineyard.—Lenoir; Dog Ridge (champini); Aramon × rupestris Ganzin, No. 1; Mourvedre × rupestris, No. 1202; monticola × riparia, No. 18815; monticola × rupestris; rupestris Pillans; rupestris St. George; monticola × riparia, No. 18808; berlandieri × riparia, No. 34 E. M.; riparia × (cordifolia × rupestris), No. 106-8; Constantia; Solonis × riparia, No. 1616; Solonis × Othello, No. 1613; riparia × rupestris, No. 101-14; Salt Creek.

Elk Grove Experiment Vineyard.—Aramon × rupestris Ganzin, No. 1; Lenoir; Aramon × rupestris Ganzin, No. 2; Dog Ridge (champini); Constantia; (aestivalis × monticola) × (riparia × rupestris), No. 554-5; monticola × riparia, No. 18815; rupestris St. George; Solonis × Othello, No. 1613; Solonis × riparia, No. 1616; monticola × riparia, No. 18804; riparia × rupestris, No. 108-103; riparia × (cordifolia × rupestris), No. 106-8; rupestris × berlandieri, No. 219-A; riparia × rupestris, No. 3309; berlandieri × riparia, No. 420-A; Mourvedre × rupestris, No. 1202; Salt Creek.

Fresno Experiment Vineyard.—Solonis × Othello, No. 1613; Mourvedre × rupestris, No. 1202; Constantia; monticola × riparia, No. 18815; australis (Jaeger); Aramon × rupestris Ganzin, No. 2; Dog Ridge (champini); Solonis × riparia, No. 1616; berlandieri × riparia, No. 34 E. M.; rupestris × cordifolia, No. 107-11; riparia × rupestris, No. 3309; cordifolia × riparia, No. 125-1; monticola × riparia, No. 18804; rupestris St. George; riparia × rupestris, No. 101; berlandieri × riparia, No. 420-A; Salt Creek; riparia × (cordifolia × rupestris), No. 106-8.

Oakville Experiment Vineyard.—Mourvedre × rupestris, No. 1202; rupestris St. George; Lenoir; riparia × rupestris, No. 101; Aramon × rupestris Ganzin, No. 1; Dog Ridge (champini); Solonis × Othello, No. 1613; Aramon × rupestris Ganzin, No. 2; Solonis × riparia, No. 1616; riparia × rupestris, No. 3306; riparia × (cordifolia × rupestris), No. 106-8; berlandieri × riparia, No. 33 E. M.; monticola × rupestris; berlandieri × riparia, No. 420-A; Salt Creek.

Conejo Experiment Vineyard.—Solonis × Othello, No. 1613; Constantia; Solonis × riparia, No. 1616; Dog Ridge (champini); Mourvedre × rupestris, No. 1202; rupestris St. George; riparia Gloire; riparia × rupestris, No. 3306; riparia × rupestris, No. 3309; Lenoir; Aramon × rupestris Ganzin, No. 2.

Livermore Experiment Vineyard.—Mourvedre × rupestris, No. 1202; rupestris St. George; Aramon × rupestris Ganzin, No. 1; monticola × riparia, No. 18815; Dog Ridge (champini); riparia × rupestris, No. 101-14; monticola × riparia, No. 18804; riparia × rupestris, No. 101; Solonis × Othello, No. 1613; berlandieri × riparia, No. 34 E. M.

Lodi Experiment Vineyard.—Solonis × Othello, No. 1615; Mourvèdre × rupestris, No. 1202; (aestivalis × monticola) × (riparia × rupestris, No. 554-5); riparia × rupestris, No. 101-14; rupestris × berlandieri, No. 219-A; rupestris St. George; riparia × rupestris, No. 101; berlandieri × riparia, No. 420-A; Aramon × rupestris Ganzin, No. 1; monticola × riparia, No. 18804; monticola × riparia, No. 18808; riparia × (cordifolia × rupestris), No. 106-8.

Mountain View Experiment Vineyard.—Dog Ridge (champini); Mourvèdre × rupestris, No. 1202; Aramon × rupestris Ganzin, No. 1; Aramon × rupestris Ganzin, No. 2; riparia × rupestris, No. 3306; Solonis × Othello, No. 1615; riparia × rupestris, No. 3309; rupestris × berlandieri, No. 201-A; Solonis × riparia, No. 1616; rupestris St. George; monticola × riparia, No. 18815; berlandieri × riparia, No. 420-A.

Oakville Experiment Vineyard.—Aramon × rupestris Ganzin, No. 2; Constantia; berlandieri × riparia, No. 33 E. M.; Dog Ridge (champini); Aramon × rupestris Ganzin, No. 1; Solonis × Othello, No. 1615; (aestivalis × monticola) × (riparia × rupestris, No. 554-5); riparia × rupestris, No. 101-14; riparia × rupestris, No. 101; riparia × rupestris, 108-103; australis (longii); rupestris St. George; Salt Creek; berlandieri × riparia, No. 34 E. M.; cordifolia × riparia, No. 125-1; berlandieri × riparia, No. 420-A; Mourvèdre × rupestris, No. 1202; Lenoir; rupestris × berlandieri, No. 219-A; monticola × riparia, No. 18815; riparia × rupestris, No. 3306; riparia × rupestris, No. 3309.

Sonoma Experiment Vineyard.—Solonis × Othello, No. 1615; berlandieri × riparia, No. 420-A; Lenoir; rupestris × berlandieri, No. 201-A; riparia × rupestris, No. 101-14; Aramon × rupestris Ganzin, No. 1; monticola × riparia, No. 18815; riparia × rupestris, No. 108-103; rupestris × berlandieri, No. 219-A; rupestris St. George; Solonis × riparia, No. 1616; Dog Ridge (champini); australis (longii); monticola × riparia, No. 18804; riparia Gloire; riparia × (cordifolia × rupestris), No. 106-8; Mourvèdre × rupestris, No. 1202; berlandieri × riparia, No. 34 E. M.; riparia × rupestris, No. 101; cordifolia × riparia, No. 125-1; riparia × rupestris, No. 3306; riparia × rupestris, No. 3309.

Stockton Experiment Vineyard.—Rupestris St. George; Solonis × riparia, No. 1616; berlandieri × riparia, No. 34 E. M.; riparia × rupestris, No. 3309; monticola × riparia, No. 18804; riparia × rupestris, No. 101; riparia × (cordifolia × rupestris), No. 106-8; Mourvèdre × rupestris, No. 1202; monticola × riparia, No. 18815; Constantia; Dog Ridge (champini); Lenoir; Solonis × Othello, No. 1615; rupestris × berlandieri, No. 219-A; berlandieri × riparia, No. 420-A; Aramon × rupestris Ganzin, No. 2.

Table 5 gives the resistant varieties in each vineyard which are estimated to have made the most creditable growth records as compared with all the varieties tested. The number on the line with each name in the vineyard column shows the relative growth rating made by the variety in the respective vineyards where it is being tested. The highest rating is expressed by the figure 1, the next by 2, and so on. The ratings represent the behavior of each variety under the conditions existing at the several vineyards, expressed in terms that permit comparison with its behavior elsewhere and in comparison also with other varieties in the same vineyard. To illustrate: Of all the varieties at Livermore, the best records were made by Mourvèdre × rupestris, No. 1202 (rated as 1), whereas at Stockton it was eighth best (expressed by 8), and at Sonoma seventeenth best (expressed by 17).

A
B
C
D

Upper and lower sides of leaves of four hybrids originated in France and extensively grown in the United States. A, Riparia × rupestris, No. 3306, one-eighth natural size. B, Monticola × rupestris, No. 1202, five-sixteenths natural size. C, riparia × rupestris, No. 101, five-fourteenths natural size. D, riparia × rupestris, No. 3309, one-third natural size.

A
B
C
D

A
B

TABLE 5.—[illegible] of grapes showing the best growth records, showing [illegible] in each of the 17 experimental vineyards in California

Variety	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible], No [illegible]	4		6					5		7		
Aramon × rupestris Ganzin, No. 1	1	3	1		5		3	9	3	3	6	
[illegible], No. 2			[illegible]	[illegible]	[illegible]	11			[illegible]			[illegible]
Australis (longii)	[illegible]			[illegible]						[illegible]	[illegible]	
Berlandieri × riparia, No. 33 E. M.					[illegible]							
Berlandieri × riparia, No. 34 E. M.		[illegible]		[illegible]			[illegible]			[illegible]	[illegible]	[illegible]
Berlandieri × riparia, No. 420 A			[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	12	[illegible]	[illegible]		[illegible]						[illegible]
Cordifolia × riparia, No. 125-1				[illegible]						[illegible]	[illegible]	
Dog Ridge (champini)	2	2	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		11
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
[illegible], No. [illegible]			[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]
Monticola × riparia, No. 18808		[illegible]	[illegible]									
Monticola × riparia, No. 18815	6	5	7	4			4		11	20	7	9
Monticola × rupestris		6			12							
[illegible], No. [illegible]	[illegible]	[illegible]	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]											[illegible]	
[illegible], No. [illegible]	[illegible]											
[illegible], No. [illegible]				[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible], No. [illegible]		[illegible]					[illegible]	[illegible]		[illegible]	[illegible]	
[illegible], No. [illegible]		[illegible]	[illegible]							[illegible]	[illegible]	
[illegible], No. 3306					10	8			6	27	27	
[illegible], No. 3309			16	11		9			7	22	23	6
Riparia × (cordifolia × rupestris), No. [illegible]		[illegible]	14	[illegible]	11			13			[illegible]	[illegible]
[illegible]	11	[illegible]										
Rupestris St. George	12	8	8	14	2	6	2	6	10	12	10	1
Rupestris × berlandieri, No. 219-A			15					5		19	9	14
Rupestris × berlandieri, No. 301-A									5		4	
Rupestris × cordifolia, No. 107-11				10								
[illegible]	7	16	19	17	15					13		
Solonis × Othello, No. 1613	11	14	9	1	7	1	9	1	6	6	1	11
[illegible], No. [illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]

VALUE AND USE OF HYBRIDS

In the attempts to obtain resistants suited to soil, climatic, and other conditions and which at the same time would prove congenial, lasting, and productive stocks on which to graft the vinifera varieties, many difficulties were encountered. For instance, the stock may be adapted to the soil, but it may be so hard to root as to make its commercial use impracticable. Again, the stock may be suited to the soil and it may root easily and be resistant, but not congenial to or make a lasting junction with vinifera varieties, or the congeniality of the variety may be good but the fruitfulness of the graft may be impaired.

In many cases also no resistant species are exactly suited to the soil and climatic conditions. To overcome such difficulties and others of like nature, hybrids have been and are being produced, in the breeding of which such of the American species were selected as possessed the various qualities desired. (Pls. 8 and 9.) In this work some remarkable successes have been achieved, such, for instance, as riparia × rupestris, No. 101; riparia × rupestris, No. 3306; riparia × rupestris, No. 3309; Solonis × Othello, No. 1613; rupestris × cordifolia, Nos. 107-11; riparia × (cordifolia × rupestris), No. 106-8; rupestris × berlandieri, No. 301-A; berlandieri × riparia, No. 420-A; and monticola × riparia, No. 18808.

Establishing vineyards on phylloxera-resistant stocks is accomplished in two entirely different ways.

(1) Resistant stocks, either cuttings or young rooted vines from the nursery, are bench grafted with the desired vinifera varieties and grown in the nursery for one year, or resistant stocks growing in the nursery are grafted with the desired vinifera varieties and allowed to remain in the nursery one year. The following spring the grafted vines obtained in either way are used in direct vineyard plantings.

(2) Resistant stock varieties are planted directly in the vineyard and when thoroughly established are grafted with the desired vinifera varieties where they are to grow.

Experiments with various resistant stocks show them to be valuable only in soils and under other conditions to which they are suited. Some have been found too difficult to root from cuttings, which makes them expensive for use in bench grafting; others, rooting easily as cuttings, do not bench graft successfully; and some stocks are suitable for direct vineyard plantings only; all of which are important considerations in the cost of establishing resistant vineyards.

Table 6 gives a list of the more useful and valuable resistant stock varieties and gives the determinations obtained by observation of and experimentation on the more valuable of such hybrid resistant stocks, the soil conditions for which they are best suited, their rooting percentages as cuttings, and their relative value when grafted as cuttings or as rooted vines, and when planted directly in the vineyard or grafted in the vineyard.

TABLE 6.—*Resistant stock varieties, the soil and conditions for which each is best suited, the relative rooting percentages of their cuttings, their relative value for bench grafting, and their relative value for direct planting and grafting in vineyards*

Variety	Rooting percentage of cuttings	Value for bench grafting as cuttings	Value for bench grafting as rooted vines	Value for [illegible]	Soils and conditions for which best suited
(Aestivalis × monticola) × riparia (Jaeger), No. [illegible]	95	25	90	90	[illegible]
Aramon × rupestris Ganzin, No. 1	90	30	80	92	[illegible]
Aramon × rupestris Ganzin, No. 2	85	10	80	90	[illegible]
Aestivalis × (rupestris × riparia), No. [illegible]	40	50	85	85	Moist, [illegible]
Berlandieri × riparia, No. 33 E. M.	30	25	90	90	[illegible]
Berlandieri × riparia, No. 34 E. M.	30	25	90	90	Do.
Berlandieri × riparia, No. 420-A	25	40	85	90	[illegible] moisture.
Chasselas × Berlandieri, No. 41-B	60	50	90	90	[illegible]
Constantia	85	60	95	95	[illegible]
Cordifolia × riparia, No. 125-1	90	65	90	90	[illegible]
Dog Ridge	**20**	**10**	**95**	**95**	[illegible] to a variety of soils.
Lenoir	20	5	90	95	Warm, deep, gravelly, [illegible]
Monticola × riparia, No. 18804	60	30	80	85	[illegible]
Monticola × riparia, No. 18808	80	65	95	90	Do.
Monticola × riparia, No. 18815	80	65	95	90	Do.
Monticola × rupestris	90	70	95	95	Acid, [illegible] gravelly [illegible]
Mourvedre × rupestris, No. 1202	92	5	80	95	Moist, heavy, [illegible] clay [illegible]
Riparia Gloire	75	50	85	90	Moist, [illegible] sandy, along creek and river bottoms.

TABLE 6.—*Resistant stock varieties, the soil and conditions for which each is best suited, the relative resting percentages of their cuttings, their relative value for bench grafting, and their relative value for direct planting and grafting in vineyards.*—Continued

Variety	Resting percentage of cuttings	Value for bench grafting in cuttings	Value for bench grafting in rooted cross	Value for vineyard grafting	Soils and conditions for which best suited
[illegible]	60	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	50	30	90	[illegible]	Deep, heavy, fertile alluvial soils
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Deep, cool, fertile clay, heavy alluvial flooded bottom land
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Arid, poor, land with effective moisture
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Arid, [illegible] land with effective moisture
Rupestris × berlandieri, No. 301-A	40	20	83	[illegible]	Do.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] effective moisture
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solonis × riparia, No. 1616	40	20	83	90	Do.

DIRECT PRODUCERS ORIGINATED IN EUROPE AND IN THE UNITED STATES

The important European grape-producing countries have endeavored to produce hybrids between the vinifera and the American native grape species which would be resistant to *Phylloxera viticola* and at the same time yield sufficient crops of fruit of desirable character and quality. It was reasoned that if such direct producers could be obtained, the time and cost of grafting would not only be saved but congeniality would not have to be considered. Some remarkable strides are being made in this direction. The more promising of these hybrids have been introduced and tested in the department's experiment vineyards, but no complete successes were found among them. Either the hybrid reverted too far toward the vinifera, and the phylloxera-resistant qualities were found wanting, or too much toward the resistant, thus impairing the quality of the fruit, or both resistance and the quantity and quality of the fruit of the hybrid were undesirable. So far, none of them are equal to the improved finer American juice-grape varieties or hybrids of American native grape species.

No doubt American grape history suggested this plan of crossing, for in this country such men as Rogers and Ricketts crossed labrusca with vinifera principally to obtain varieties hardy to American conditions, but in which the strong foxy flavor and aroma of the labrusca would be at least partly eliminated. The late T. V. Munson, however, went a step farther and originated not only valuable hybrids of vinifera and American Euvitis but many valuable hybrids of American native grape species that already are destined to feature conspicuously in American viticulture.

Table 7 gives an alphabetical list of the direct producers originated in Europe and the United States that have been tested on their own roots in the department's California experiment vineyards. (PL. 10.) Column 1 gives the varietal name and shows the parentage (whether a seedling of a single species or a hybrid of different species), the abbreviations used to designate the species being A for aestivalis, Ba for bourquiniana, C for cordifolia, Cn for candicans, Cl. for champini, La for labrusca, Li for linsecomii, R for riparia, Ru for rupestris, and V for vinifera. Column 2 shows the experiment vineyards in which the growth was tested, use being made of the following abbreviations: C for Chico, Cx for Cutlas, EG for Elk Grove, F for Fresno, G for Geyserville, Gi for Guasti, L for Lodi, Li for Livermore, M for Mountain View, O for Oakville, S for Sonoma, and St for Stockton. Column 3 shows the number of years covered by the test. Column 4 shows the growth and adaptability of each variety at each vineyard where it is under test, expressed in the form of a percentage rating on a scale in which 100 per cent is taken as the standard of excellence. Column 5 gives the pruning method, s being used for spurs and c for canes. Column 6 gives the codes at which fruit is borne; 7 and 8, the growth-starting dates in early and late seasons; 9 and 10, the blossoming dates in early and late seasons; 11 and 12, the fruit-setting dates in early and late seasons; 13 and 14, the fruit-ripening dates in early and late seasons. Column 15 shows the condition of productiveness, whether excellent (e), good (g), medium (m), or poor (p); column 16, the bearing habit, whether regular (r) or occasional (o); column 17, the average percentage of sugar, Balling scale; column 18, the average acid, as tartaric per 100 c. c. (sugar and acid determinations and fruit-ripening dates are given only of such varieties as it was thought might be worth while). Column 19 shows the size of the cluster, whether medium (m), medium to large (z), large (l), very (v), or small (s). Column 20 shows the shape of the clusters, whether round (r), cylindrical (c), long (l), or tapering (t). Column 21 designates the density of the clusters, whether compact (c), medium (m), or loose (l). Column 22 shows the size of the berry, whether large (l), medium (m), or small (s). Column 23 gives the shape of the berry, whether round (r), oval (o), or oblong (b). Column 24 shows the color of the berry, whether black (b), red (r), or white (w). Column 25 indicates the purpose for which the fruit is used, whether for table (t), shipping (s), juice (j), wine (w), or cold storage (c). In this table the nomenclature of varieties has been brought into conformity with the code of the American Pomological Society[1] in so far as has appeared practicable.

[1] AMERICAN POMOLOGICAL SOCIETY. CODE OF FRUIT NOMENCLATURE. 4 p., mimeographed. [Unpublished.]

TABLE 7.—*Relative behavior and value for different purposes of grape [illegible] [illegible] originated in Europe and in the United States growing on their own roots in [illegible] experimental [illegible] in California*

Variety and parentage	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Growth-beginning date: Early season	Growth-beginning date: Late season	Blossoming date: Early season	Blossoming date: Late season	Fruit-ripening date: Early season	Fruit-ripening date: Late season	[illegible] date: Early season	[illegible] date: Late season	[illegible]	[illegible]	[illegible]	[illegible]	Cluster: Size	Cluster: Shape	Cluster: Compactness	Berry: Size	Berry: Shape	Berry: Color	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A[illegible]:																								
V[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 12	Apr [illegible]	[illegible]	May [illegible]	May 11	....	....	[illegible]	f			m	c	mc	m	f	f	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 24	May [illegible]	[illegible]	May 21	June 14	Oct. 12	Oct. 15	[illegible]	f	...	...	m	c	mc	m	f	f	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 21	Apr 25	May 1	Apr [illegible]	May 6	....	....	[illegible]	f	...	...	m	c	mc	m	f	f	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 10	May 6	May 27	May [illegible]	May 29	Sept. 16	Oct. 4	[illegible]	f	22	[illegible]	m	c	mc	m	f	f	[illegible]
A[illegible]:																								
[illegible] (La. × Be.)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	[illegible]	[illegible]	do.	May 20	....	....	[illegible]	f	...	...	l	l	m	m	...	w	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 2[illegible]	[illegible]	[illegible]	Apr [illegible]	June 1	Sept. 10	Oct. 21	[illegible]	f	22	1 [illegible]	l	l	m	m	...	w	[illegible]
A[illegible] Winter:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	[illegible]	[illegible]	[illegible]	May 9	....	....	[illegible]	f	...	...	ms	l	l	m	f	f	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	[illegible]	[illegible]	May [illegible]	May 27	....	....	[illegible]	f	...	...	ms	l	l	m	f	f	[illegible]
A[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	Apr 20	June 4	May 4	June 11	....	....	[illegible]	f	...	...	s	ll	ml	ms	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	May [illegible]	[illegible]	do.	do.	Sept. 20	Oct. 28	[illegible]	f	25	[illegible]	s	ll	ml	ms	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	May [illegible]	May 16	May 14	May 23	....	....	[illegible]	f	...	...	s	ll	ml	ms	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 12	....	....	....	....	....	....	[illegible]	f	...	...	s	ll	ml	ms	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	May 21	May 30	May 2[illegible]	June 2	Sept. 10	Oct. 11	[illegible]	f	26	[illegible]	s	ll	ml	ms	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 1[illegible]	May 23	June 2	May 2[illegible]	June [illegible]	....	....	[illegible]	f	...	...	s	ll	ml	ms	f	b	[illegible]
A[illegible] Tama, No. 20:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 1[illegible]	May 10	[illegible]					[illegible]	f	...	...	ms	c	c	m	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	Apr 2[illegible]							[illegible]	f			ms	c	c	m	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 12	[illegible]	[illegible]	[illegible]			[illegible]	f			ms	c	c	m	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 11	[illegible]	[illegible]	[illegible]	Sept. [illegible]	Oct. [illegible]	[illegible]	f	20	[illegible]	ms	c	c	m	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 2	May 10	[illegible]	[illegible]	[illegible]			[illegible]	f	...		ms	c	c	m	f	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 10	May [illegible]	[illegible]	[illegible]	[illegible]			[illegible]	f	...		ms	c	c	m	f	b	[illegible]
A[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr 7	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	o	...		m	l	mc	ms	f	f	[illegible]
Do.	[illegible]			[illegible]		[illegible]	Apr 6							[illegible]	o	...		m	l	mc	ms	f	f	[illegible]
Do.	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	Apr 5	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	o	...		m	l	mc	ms	f	f	[illegible]
A[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr [illegible]	Apr [illegible]	May [illegible]	Apr [illegible]	May [illegible]			[illegible]	o	...		[illegible]	....	l	m	ro	f	l

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 18 experiment vineyards in California*—Continued

Variety and parentage	Experiment vineyard	Period planted	Growth rating	How pruned	Nodes bearing fruit	Growth-beginning date: Early season	Growth-beginning date: Late season	Blooming date: Early season	Blooming date: Late season	Fruit-setting date: Early season	Fruit-setting date: Late season	Fruit-ripening date: Early season	Fruit-ripening date: Late season	[illegible]	[illegible]	[illegible]	[illegible]	Cluster: Size	Cluster: Shape	Cluster: Compactness	Berry: [illegible]	Berry: [illegible]	Berry: [illegible]	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Apr. 1	May 2	May 18	May 5	May 22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	June 1	May 9	June 6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May 28	June 4	June 1	June 7	Sept. 20	Oct. 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

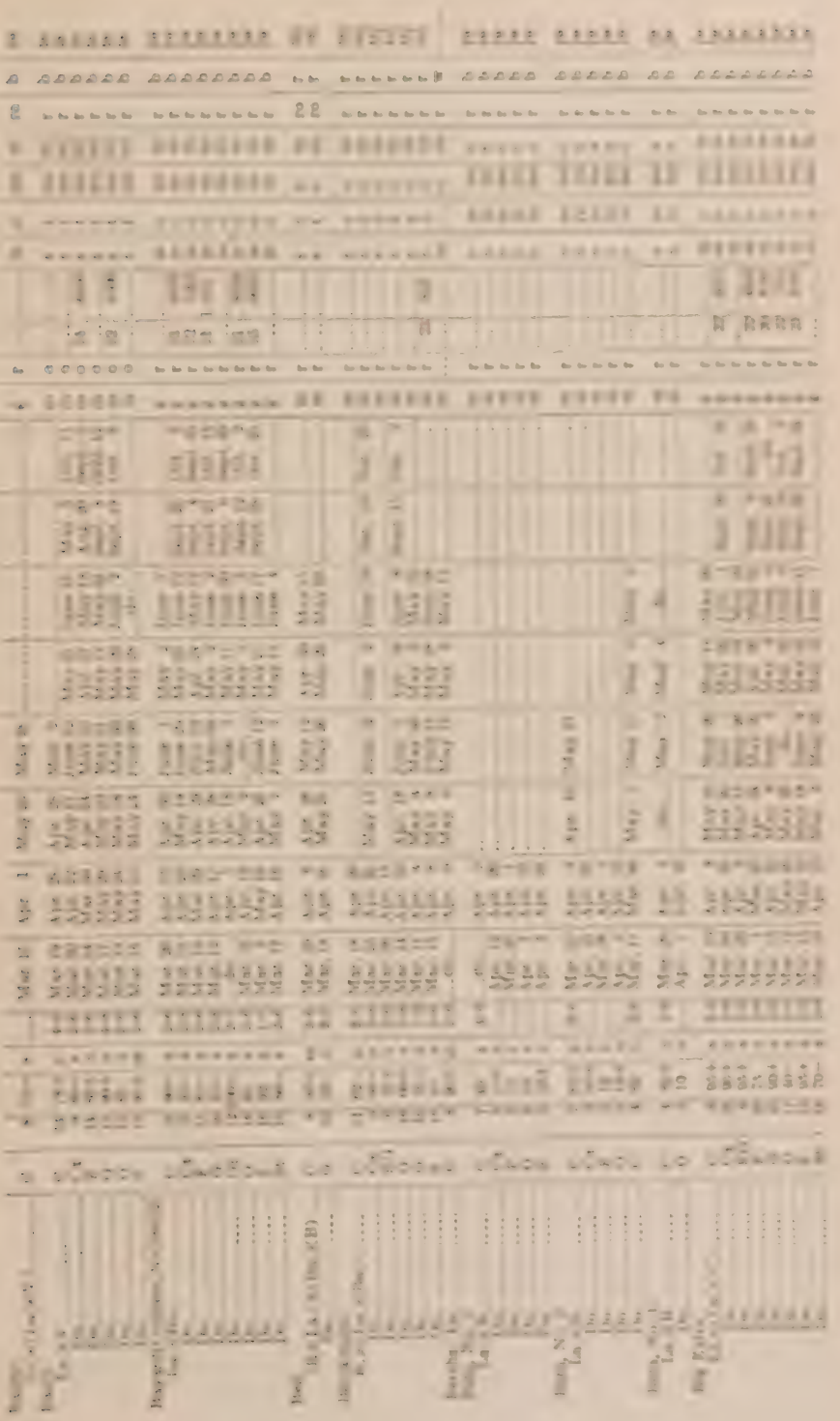

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experiment vineyards in California*—Continued

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experiment vineyards in California*—Continued

Variety and parentage	Experiment vineyard	Period planted (years)	Growth rating	How planted	Nodes bearing fruit	Growth starting date: Early season	Growth starting date: Late season	Blossoming date: Early season	Blossoming date: Late season	Fruit setting date: Early season	Fruit setting date: Late season	Fruit ripening date: Early season	Fruit ripening date: Late season	Productiveness	Bearing habit	Sugar, Balling scale	Acid, as tartaric, grams per 100 c.c.	Cluster: Size	Cluster: Shape	Cluster: [illegible]	Berry: Size	Berry: Shape	Berry: Color	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Carignane×rupestris, No. [illegible]:																								
V×Ru	[illegible]	13	90	[illegible]	[illegible]	Mar. 12	Apr. 26	Apr. 10	May [illegible]	Apr. 30	May 21			[illegible]	[illegible]			m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 6	May 12	May 18	May [illegible]	May 21			[illegible]	[illegible]			m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 4	Mar. 18	May 16	May 10	May 20			[illegible]	[illegible]			m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	May 28	Mar. 21	May [illegible]	May [illegible]	June [illegible]	Oct. [illegible]	Oct. [illegible]	[illegible]	[illegible]	23	[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 6	May 16	June 2	May 21	June [illegible]	Sept. 22	Oct. [illegible]	[illegible]	[illegible]	23	[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	12	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 10	May 1	do	May 4	June 5			[illegible]	[illegible]			m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carignan:																								
([illegible])×(La×Ba.)	O	[illegible]	[illegible]	[illegible]	[illegible]	do	May 28	May 20	June 3	June 1	June 7	Sept. 10	Oct. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Catawba:																								
La×V	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 8	May 8	May 18	May 11	May 21			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	14	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 16							[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	[illegible]	May 10	June 8	May [illegible]	June [illegible]	Sept. 18	Oct. [illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 9	May 2	May [illegible]	May 4	May [illegible]	Sept. 14	Oct. [illegible]	[illegible]	[illegible]	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 11	May 15	May [illegible]	June [illegible]	May [illegible]	June [illegible]	Sept. 22	Oct. [illegible]	[illegible]	[illegible]	24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cayuga:																								21
La×V	[illegible]	[illegible]	90−	[illegible]	[illegible]	Mar. 10	Mar. 30	Apr. [illegible]	May 4	Apr. [illegible]	May 7			[illegible]	[illegible]				[illegible]		[illegible]		[illegible]	
Centennial:																								
La×A×V	[illegible]	[illegible]	70+	[illegible]	[illegible]	Mar. 14	May 15	Apr. [illegible]	May [illegible]	Apr. [illegible]	May 10			[illegible]		24	[illegible]	ms	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	100+	[illegible]	[illegible]	Mar. 13	Apr. 10	Apr. [illegible]	May [illegible]	May [illegible]	May [illegible]			[illegible]				ms	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	98+	[illegible]	[illegible]	Mar. 15	May 20	Mar. 21	May [illegible]	May [illegible]	May 11	Sept. 10	Oct. [illegible]	[illegible]		21	[illegible]	ms	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Challenge:																								
La×V	O	[illegible]	10−	[illegible]		Apr. 1	Apr. 8																	
Chautauqua:																								
([illegible]×La)×V×Ba.	[illegible]	[illegible]	30+	[illegible]	[illegible]	Mar. [illegible]	Apr. 20											m	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Do	O	[illegible]	5−	[illegible]	[illegible]	do	Apr. 16	May [illegible]	June 1	May [illegible]	June [illegible]							m	----		[illegible]		[illegible]	
Do	[illegible]	[illegible]	90+	[illegible]		Mar. [illegible]	May 4											m	----		[illegible]		[illegible]	
Champanel:																								
([illegible]×La)	C	14	100+	[illegible]	[illegible]	Mar. 22	Apr. 28	Apr. [illegible]	May [illegible]	Apr. [illegible]	May [illegible]													
Do	E.O	[illegible]	100+	[illegible]	[illegible]	Mar. 24	Apr. 6	May [illegible]	May 24	May [illegible]	June [illegible]			[illegible]	[illegible]			m	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Do	O	12	9[illegible]	[illegible]	[illegible]	Mar. 13	May 20	May [illegible]	May [illegible]	May 22	May [illegible]	Sept. 10	Oct. 11	[illegible]	[illegible]	[illegible]	[illegible]	m	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

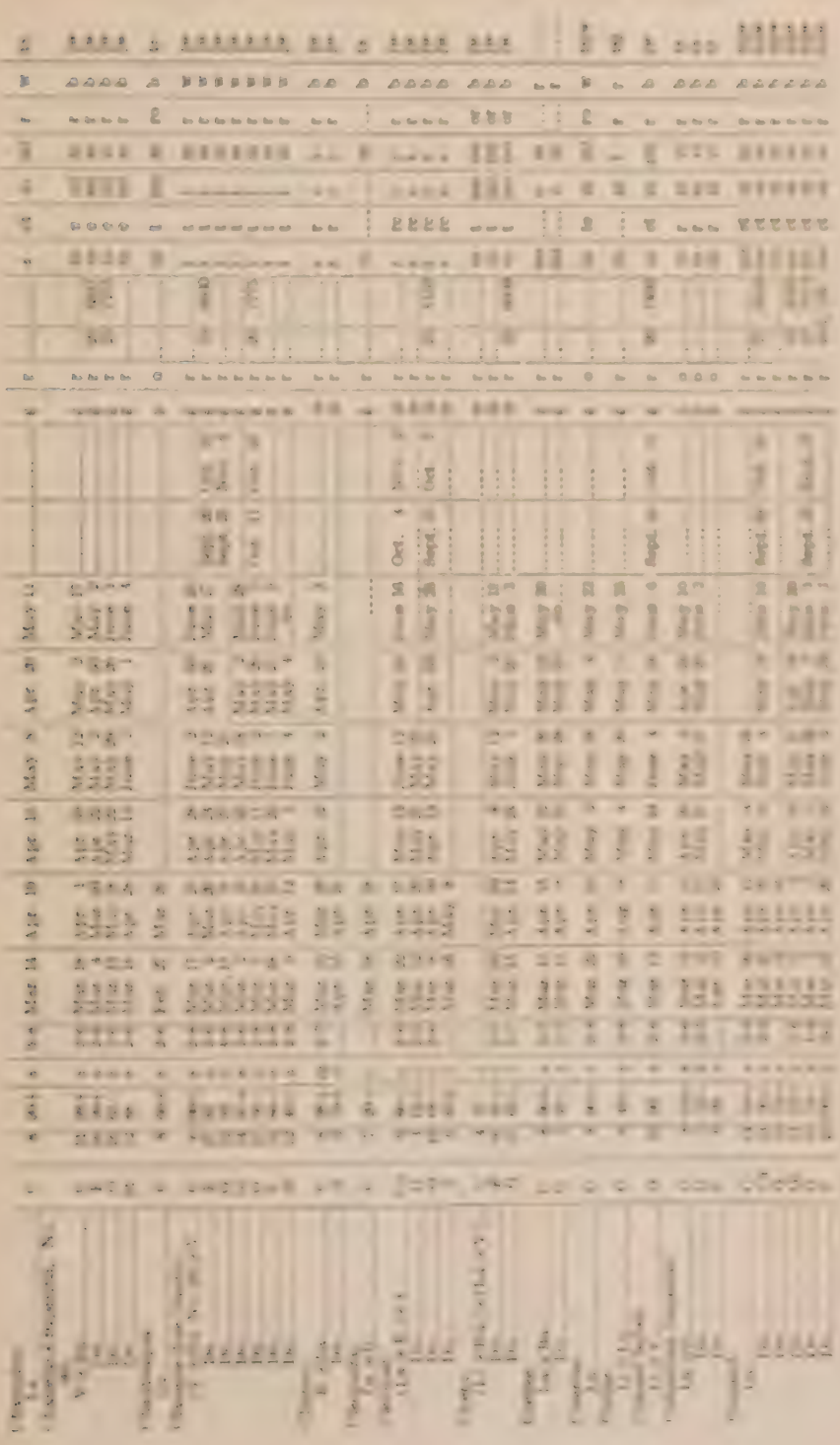

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experimental vineyards in California*—Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experiment vineyards in California*—Continued

Variety and parentage	Experiment vineyard	Period planted (years)	Growth rating	How pruned	Vines bearing fruit	Growth-starting date: Early season	Growth-starting date: Late season	Blossoming date: Early season	Blossoming date: Late season	Fruit-setting date: Early season	Fruit-setting date: Late season	Fruit-ripening date: Early season	Fruit-ripening date: Late season	Productiveness	Bearing habit	Sugar (Balling scale)	Acid	Cluster: Size	Cluster: Shape	Cluster: Compactness	Berry: Size	Berry: Shape	Berry: Color	Use
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Diana																								
La × V × A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 10	Apr. 28	May 19	May 1	May 23			[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	r	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 24	May [illegible]	June [illegible]	May [illegible]	July [illegible]	Sept. [illegible]	Oct. [illegible]	[illegible]	p	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	r	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	Apr. [illegible]	June 1	Apr. [illegible]	May [illegible]			[illegible]	p	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	r	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	do.	May 20	May 22	May 30	May [illegible]	June [illegible]	Sept. [illegible]	Oct. [illegible]	[illegible]	p	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	r	[illegible]
[illegible]																								
[illegible] × La	[illegible]	[illegible]	[illegible]	[illegible]		Mar. 24	Apr. 2							[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]					......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		Mar. [illegible]	May [illegible]					......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
[illegible]																								
V × A × La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	May 20	May [illegible]	May 24	June 2	Sept. 23	Oct. 8	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dracut Amber																								
La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	Apr. [illegible]	May [illegible]	Apr. 20	May [illegible]	......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	May [illegible]	June [illegible]			......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]
Dutchess																								
(V × La) × Bu	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	May [illegible]	June [illegible]	May [illegible]	June [illegible]	......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	p	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sept. 17	Sept. 18	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sept. 10	Sept. 24	[illegible]	p	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	May [illegible]	do.	June [illegible]	May 27	June [illegible]	Sept. 11	Oct. 28	[illegible]	p	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Early Dawn																								
La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 17	Apr. [illegible]	May [illegible]	May [illegible]	May [illegible]	May [illegible]	Sept. 23	Oct. 15	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	b	[illegible]
Early Daisy																								
La × V × A	[illegible]	6	[illegible]	[illegible]	[illegible]	Mar. 28	do.	May 4	May [illegible]	May [illegible]	May 17	......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	b	[illegible]
Early Victor																								
La × Bu	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	do.	Apr. [illegible]	May [illegible]	May 18	May [illegible]	May 21	......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		Mar. [illegible]	Apr. [illegible]					......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		Mar. 14	May [illegible]					......	......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	r	b	[illegible]
Eclipse																								
La	[illegible]	6	[illegible]	[illegible]		do.	Apr. 2						......	[illegible]	p			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	b	[illegible]
Eldorado																								
La × V	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 1	Apr. 28	May [illegible]	May [illegible]	May 9		......	[illegible]	o			......			[illegible]	r	w	t

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experiment vineyards in California*—Continued

Variety and parentage	Experiment vineyard	Period [illegible] (years)	Growth rating	Row [illegible]	Nodes bearing fruit	Growth starting date: Early season	Growth starting date: Late season	Blossoming date: Early season	Blossoming date: Late season	Fruit setting date: Early season	Fruit setting date: Late season	Fruit ripening date: Early season	Fruit ripening date: Late season	Productivity	Bearing habit	Sugar, Balling test	Acid [illegible]	Cluster: [illegible]	Cluster: [illegible]	Cluster: [illegible]	Berry: [illegible]	Berry: [illegible]	Berry: [illegible]	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Gaertner																								
V × La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 21	Apr. 30	May [illegible]	June 1	May 3	June 4			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 14	do.	May 29	do.	May 29	do.	Oct. 6	Oct. [illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Glenfield																								
La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 26	Apr. 6	May [illegible]	May [illegible]	May 6	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Goethe																								
La × V	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 19	Apr. 3	do.	May [illegible]	May 4	May 24			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gold Dust																								
La × V × Ba	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 11	Apr. 4	May [illegible]	May [illegible]	May 20	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	do.	Apr. 2	May 6	May [illegible]					[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Golden Drop																								
La × V × Ba	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	do.	Apr. 20	May 6	Apr. 28	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		Mar. [illegible]	Apr. 6							[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Golden Grain																								
La × V × Ba	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 12	Apr. 4	May [illegible]	May [illegible]	May [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gold Coin																								
A × La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 14	Apr. [illegible]	May [illegible]	June [illegible]	May [illegible]	June [illegible]	Sept. [illegible]	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	May [illegible]	[illegible]	[illegible]	[illegible]	June [illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Governor Ross																								
La × V	[illegible]	14	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	May [illegible]	do.	May [illegible]	do.			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Green Early																								
La × V	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 17	Apr. 1	May 2	May [illegible]	Apr. [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Green, Chas. A																								
La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 6	Apr. 28	June [illegible]	May 27	June [illegible]	Oct. 4	Oct. [illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grein Golden																								
R × La	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. 4	Apr. 30	May 14	May [illegible]	May 18			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		Mar. 13	Apr. 15							[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hartford																								
La. × V.	C	8	90	[illegible]	[illegible]	Mar. 19	Apr. 2	Apr. 17	May [illegible]	Apr. 18	May 18			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 17 experiment vineyards in California*—Continued

Variety and parentage	Experiment vineyard	Period planted, years	Growth rating	[illegible]	Vines bearing fruit	Growth starting date: Early season	Growth starting date: Late season	Blossoming date: Early season	Blossoming date: Late season	Fruit setting date: Early season	Fruit setting date: Late season	Fruit ripening date: Early season	Fruit ripening date: Late season	[illegible]	Bearing habit	Sugar, Balling scale	[illegible] grams per 100 cc	Cluster: [illegible]	Cluster: [illegible]	Cluster: Compact or loose	Berry: Size	Berry: [illegible]	Berry: Color	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Jardin, No. [illegible]																								
([illegible]) × ([illegible])	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 21	Apr. 16	May 2	May [illegible]	May [illegible]	May 31	...		[illegible]	r	...		s	[illegible]	c	s	[illegible]	b	[illegible]
Do.	F	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 1	Apr. 5	Apr. 21	May [illegible]	Apr. [illegible]	May 26	Sept. 3	[illegible]	[illegible]	r	23	[illegible]	s	[illegible]	c	s	[illegible]	b	[illegible]
Do.	G	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 16	Apr. 9	May [illegible]	June 1	May [illegible]	June 6	Sept. 22	[illegible]	[illegible]	r	22	[illegible]	s	[illegible]	c	s	[illegible]	b	[illegible]
Do.	Gl	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 18	Apr. 12	Apr. [illegible]	May [illegible]	Apr. [illegible]	May 23	...		[illegible]	r	21	[illegible]	s	[illegible]	c	s	[illegible]	b	[illegible]
Do.	O	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 3	Apr. 7	May [illegible]	June 1	May [illegible]	June 4	Sept. 16	[illegible]	[illegible]	r	[illegible]	[illegible]	s	[illegible]	c	s	[illegible]	b	[illegible]
Do.	S	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 16	May 14	May [illegible]	Do.	May [illegible]	June 5	Sept. 22	[illegible]	[illegible]	r	[illegible]	[illegible]	s	[illegible]	c	s	[illegible]	b	[illegible]
Do.	St	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 17	Apr. 20	May [illegible]	June 2	May [illegible]	June 6	...		[illegible]	r	...		s	[illegible]	c	s	[illegible]	b	[illegible]
Jardin, No. [illegible]																								
Ru. × V.	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 23	Apr. 10	Apr. [illegible]	June 1	May [illegible]	June 5	...		[illegible]	r	...		l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	Cx	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 10	Apr. 25	May [illegible]	June [illegible]	May [illegible]	June 26	Sept. 28	[illegible]	[illegible]	r	[illegible]	[illegible]	l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	E(O)	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 16	Apr. 6	Apr. [illegible]	May [illegible]	May [illegible]	May 21	...		[illegible]	r	...		l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	F	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 14	Apr. 2	Apr. [illegible]	May [illegible]	Apr. [illegible]	May 13	Sept. 3	[illegible]	[illegible]	r	[illegible]	[illegible]	l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	G	[illegible]	[illegible]	[illegible]	[illegible]	Do.	Apr. 16	May [illegible]	May [illegible]	May [illegible]	June 3	Sept. 23	[illegible]	[illegible]	r	[illegible]	[illegible]	l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	Gl	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 12	Do.	Apr. [illegible]	May [illegible]	Apr. [illegible]	May 23	Sept. 20	[illegible]	[illegible]	r	[illegible]	[illegible]	l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	O	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 10	Apr. 10	May [illegible]	May [illegible]	May [illegible]	June 1	Sept. 19	[illegible]	[illegible]	r	[illegible]	[illegible]	l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	S	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 15	May 6	May [illegible]	June [illegible]	May [illegible]	June 6	Sept. 21	[illegible]	[illegible]	r	[illegible]	[illegible]	l	[illegible]	l	s	[illegible]	b	[illegible]
Do.	St	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 7	Apr. 13	May [illegible]	May [illegible]	May [illegible]	June 3	...		[illegible]	r	...		l	[illegible]	l	s	[illegible]	b	[illegible]
Jefferson:																								
Lb. × V.	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	May [illegible]	May [illegible]	May [illegible]	May 28	...		[illegible]	r	...		m	[illegible]	c	l	[illegible]	r	[illegible]
Do.	Cx	[illegible]	[illegible]	[illegible]	[illegible]	Apr. 1	Apr. 25	May [illegible]	June [illegible]			Oct. [illegible]	[illegible]	[illegible]	r	...		m	[illegible]	c	l	[illegible]	r	[illegible]
Do.	O	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 19	Apr. 10	May 1	May [illegible]	May 1	May 30	Sept. 14	[illegible]	[illegible]	r	[illegible]	[illegible]	m	[illegible]	c	l	[illegible]	r	[illegible]
Jessica:																								
Lb. × V.	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 20	Apr. 28					...		[illegible]	r	...		[illegible]	[illegible]	[illegible]	m	[illegible]	w	[illegible]
Judge Miller:																								
[illegible] × Lb.	O	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 15	Apr. 10	May 23	May [illegible]	May [illegible]	May [illegible]	...		[illegible]	r	...		[illegible]	[illegible]	[illegible]	m	[illegible]	w	[illegible]
Keller White:																								
Lb. × V.	O	[illegible]	[illegible]	[illegible]		Mar. 18	Apr. 12					...		[illegible]	r	...		[illegible]	[illegible]	[illegible]	m	[illegible]	w	[illegible]
Kensington:																								
(R. × Lb.) × V.	O	4	[illegible]	[illegible]	[illegible]	Mar. 10	Apr. 6					...		[illegible]	r	...		m	ct	l	m	o	w	[illegible]

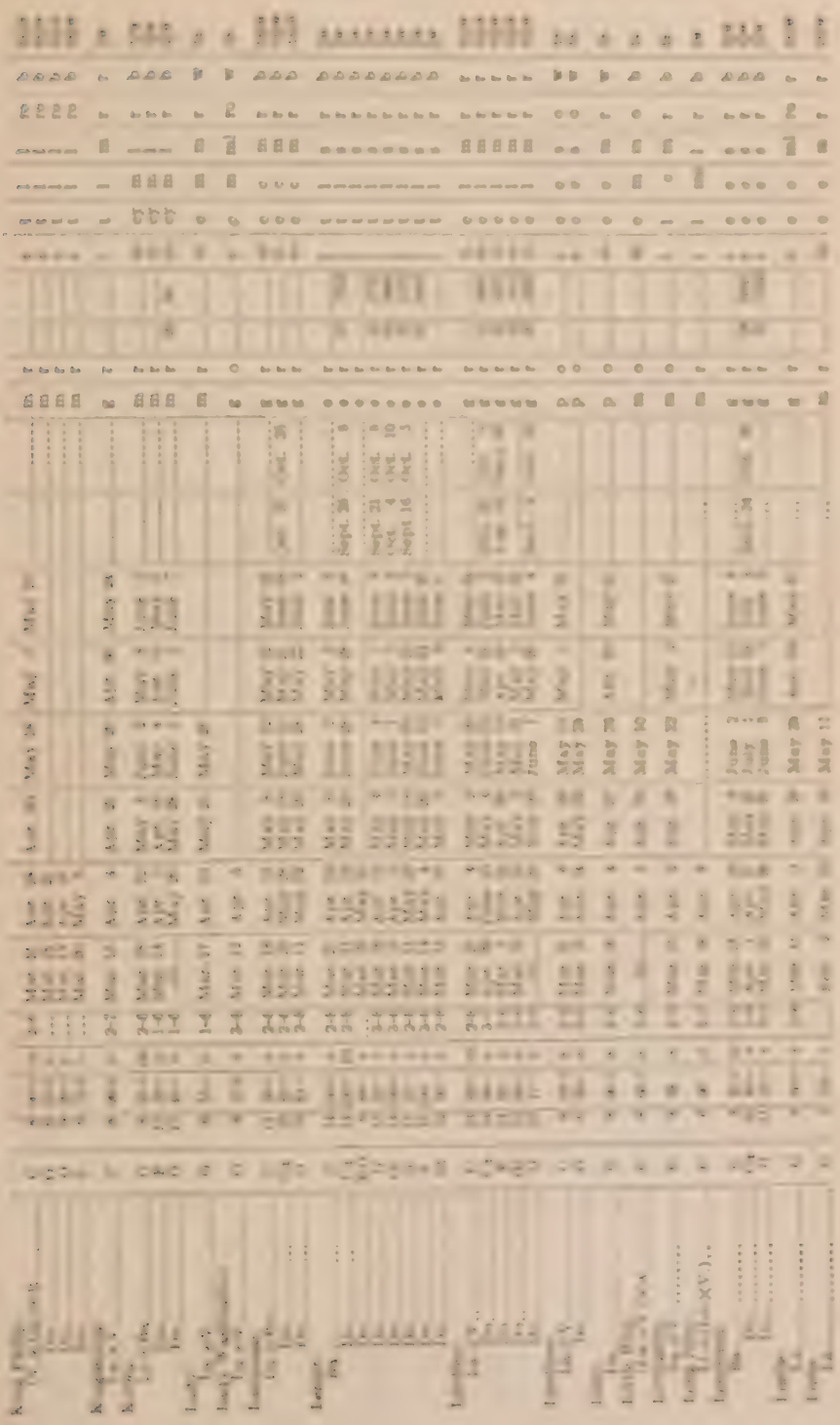

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experiment vineyards in California*—Continued

Variety and parentage	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Growth-starting date: Early season	Growth-starting date: Late season	Blossoming date: Early season	Blossoming date: Late season	Fruit-setting date: Early season	Fruit-setting date: Late season	Fruit-ripening date: Early season	Fruit-ripening date: Late season	[illegible]	[illegible]	[illegible]	[illegible]	Cluster: [illegible]	Cluster: [illegible]	Cluster: [illegible]	Berry: [illegible]	Berry: [illegible]	Berry: [illegible]	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Lukfata																								
[illegible] × La	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 20	Apr. [illegible]	Apr. 15	May [illegible]	Apr. [illegible]	June [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	F	[illegible]	65−	[illegible]	[illegible]	Mar. 10	Apr. [illegible]	Apr. 16	May [illegible]	[illegible]	May [illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	80−	[illegible]	[illegible]	Mar. 13	May [illegible]	May 12	May [illegible]	May [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Madame [illegible]																								
R × V	[illegible]	[illegible]	20−	[illegible]	[illegible]	Mar. 19	Apr. [illegible]	Apr. 28	May [illegible]	May [illegible]	June [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	82−	[illegible]	[illegible]	Mar. 16	Apr. [illegible]	May 8	May [illegible]	May [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]−	[illegible]	[illegible]	Mar. 13	Apr. [illegible]	May 22	June [illegible]	May [illegible]	June 4	Sept. [illegible]	Oct. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Madame L[illegible]																								
(V × R[illegible] × V)	[illegible]	[illegible]	82−	[illegible]	[illegible]	Mar. 17	Apr. [illegible]	Apr. 28	May [illegible]	May [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	75−	[illegible]	[illegible]	Mar. 15	[illegible]	Apr. 29	May [illegible]	May [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	[illegible]	[illegible]	[illegible]−	[illegible]	[illegible]	Mar. 10	Apr. [illegible]	May 5	May [illegible]	May [illegible]	June [illegible]	Sept. [illegible]	Oct. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Manito																								
(LF × R[illegible] × [illegible]) B[illegible]	C	[illegible]	90+	[illegible]	[illegible]	Mar. 18	May [illegible]	May 1	May [illegible]	May [illegible]	June [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	F	[illegible]	70+	[illegible]	[illegible]	Mar. 9	Apr. [illegible]	Apr. 20	May [illegible]	Apr. [illegible]	May [illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do	O	1	75−	[illegible]	[illegible]	Mar. 12	May [illegible]	May 12	May [illegible]	May [illegible]	May [illegible]	Sept. [illegible]	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Marguerite																								
LF × Ba	C	[illegible]	90+	[illegible]		Mar. 24	Apr. [illegible]	[illegible]	[illegible]					[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	96	[illegible]	[illegible]	Mar. 31	Apr. [illegible]	May 24	June [illegible]	May [illegible]	June [illegible]			[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	98+	[illegible]		Mar. 26	Apr. [illegible]							[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	75+	[illegible]	[illegible]	Mar. 10	Apr. [illegible]	Apr. 28	May [illegible]	Apr. [illegible]	May [illegible]			[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	90−	[illegible]	[illegible]	Mar. 16	Apr. [illegible]	May 8	June [illegible]	June [illegible]	June [illegible]	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	90+	[illegible]	[illegible]	Mar. 22	Apr. [illegible]	May 3	[illegible]	May [illegible]	June [illegible]			[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	80+	[illegible]	[illegible]	Mar. 15	May [illegible]	May 28	June [illegible]					[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	b	[illegible]w
Do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 16	Apr. [illegible]	May 17	June [illegible]	May [illegible]	June [illegible]			[illegible]	[illegible]	[illegible]	[illegible]	m	[illegible]	[illegible]	m	r	b	[illegible]w
Marion																								
R × La	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 18	Apr. 1	Apr. [illegible]	Apr. [illegible]	Apr. [illegible]	May 4			[illegible]	[illegible]			l	[illegible]	[illegible]	l	ro	b	[illegible]w
Martha																								
La	C	[illegible]	[illegible]	[illegible]	[illegible]	Mar. [illegible]	Apr. [illegible]	May 4	May [illegible]	May [illegible]	May 16			[illegible]	[illegible]			m	[illegible]	[illegible]	m	r	w	[illegible]w
Do	[illegible]	[illegible]	[illegible]	[illegible]		Mar. [illegible]	Apr. [illegible]	Apr. [illegible]	May [illegible]					[illegible]	[illegible]	[illegible]	[illegible]	m	[illegible]	[illegible]	m	r	w	[illegible]w

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experiment vineyards in California*—Continued

Variety and parentage	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Growth-starting date		Blossoming date		Fruit-setting date		Fruit-ripening date		[illegible]	Bearing habit	Sugar, Balling scale	Acid, as tartaric, grams per 100 c.c.	Cluster			Berry			[illegible]
						Early season	Late season	Early season	Late season	Early season	Late season	Early season	Late season					Size	Shape	Compact or loose	Size	Shape	Color	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Niagara:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 20	Apr. [illegible]							g	o			[illegible]	[illegible]	m	l	[illegible]	w	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sept. 25	Oct. [illegible]	g	o	[illegible]	[illegible]	[illegible]	[illegible]	m	l	[illegible]	w	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sept. 12	Sept. [illegible]	g	o	[illegible]	[illegible]	[illegible]	[illegible]	m	l	[illegible]	w	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sept. 19	Oct. [illegible]	g	o	[illegible]	[illegible]	[illegible]	[illegible]	m	l	[illegible]	w	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			g	o			[illegible]	[illegible]	m	l	[illegible]	w	[illegible]
[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		Mar. 20	Apr. [illegible]							o	r			[illegible]	[illegible]	o	m	[illegible]	r	[illegible]
Noah:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 10	Apr. 12	Apr. [illegible]	May 13	May 4	May 16			o	r			[illegible]	[illegible]	o	m	[illegible]	w	[illegible]
[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 22	Apr. 10	May 6	June 4	[illegible]	[illegible]			m	r			[illegible]	[illegible]	o	s	[illegible]	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 13	Apr. 13	May 23	June 1	[illegible]	[illegible]	[illegible]	Oct. 1	m	r	[illegible]	[illegible]	[illegible]	[illegible]	o	s	[illegible]	b	[illegible]
[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		Apr. 3	[illegible]							g	r			[illegible]	[illegible]	m	[illegible]	[illegible]	b	[illegible]
[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			g	r			[illegible]	[illegible]	m	m	[illegible]	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			g	r			[illegible]	[illegible]	m	m	[illegible]	b	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Oct. [illegible]	g	r	[illegible]	[illegible]	[illegible]	[illegible]	m	m	[illegible]	b	[illegible]
Olita:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			m	r			[illegible]	[illegible]	m	m	[illegible]	w	[illegible]
[illegible]:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]			Oct. [illegible]	Oct. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]							[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sept. [illegible]	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]		Mar. [illegible]	May 2							[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	r	[illegible]	[illegible]
Oneida:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mar. 17	Apr. 1	Apr. [illegible]	May [illegible]					[illegible]	[illegible]			[illegible]	[illegible]	l	[illegible]	r	r	t
Osage:																								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		Mar. [illegible]	Apr. [illegible]							[illegible]	r			[illegible]	[illegible]	[illegible]	l	r	b	t

TABLE 7.—*Reaction behavior and value for different purposes of grape clone rootstocks originated in Europe and in the United States, primarily on their use here in 14 experimental vineyards in California*—Continued

Variety or clone combination	No.	Resistance to Phylloxera	Resistance to Nematodes	Resistance to Root-rot	Resistance to Drought	Resistance to Lime	Resistance to Salt	Resistance to Alkali	Resistance to Wet Soil	Resistance to Anthracnose	Resistance to Mildew	Resistance to Oidium	Resistance to Pierce's disease	Resistance to Virus	Resistance to Crown gall	Resistance to Shot-hole	Resistance to Leaf-roll	Resistance to Fan-leaf	Resistance to Yellows	Resistance to Curly-dwarf	Resistance to Rupestris stem pitting	Resistance to Vine Weevil	Resistance to Grape Phylloxera	Resistance to Grape Berry Moth	Resistance to Thrips	Resistance to Leaf-hoppers	Resistance to Mealy-bug	Resistance to Scale	Resistance to Mites	Resistance to Nematodes	Resistance to Root-rot	Resistance to Drought	Resistance to Lime	Resistance to Salt	Resistance to Alkali	Resistance to Wet Soil	Resistance to Anthracnose	Resistance to Mildew	Resistance to Oidium	Resistance to Pierce's disease	Resistance to Virus	Resistance to Crown gall	Resistance to Shot-hole	Resistance to Leaf-roll	Resistance to Fan-leaf	Resistance to Yellows	Resistance to Curly-dwarf	Resistance to Rupestris stem pitting	Resistance to Vine Weevil	Resistance to Grape Phylloxera	Resistance to Grape Berry Moth	Resistance to Thrips	Resistance to Leaf-hoppers	Resistance to Mealy-bug	Resistance to Scale	Resistance to Mites
Rupestris du Lot	1																																																						
Riparia Gloire de Montpellier	2																																																						
Riparia Grand Glabre	3																																																						
Riparia Martin	4																																																					
Riparia Metallica	5																																																					
Riparia Rupestris 3306	6																																																					
Riparia Rupestris 3309	7																																																					
Rupestris du Lot	8																																																					
Rupestris Martin	9																																																					
Rupestris Metallica	10																																																					
Rupestris St. George	11																																																					
Solonis x Riparia 1616	12																																																					
Solonis x Riparia 1613	13																																																					
Vialla	14																																																					
Vitis Berlandieri x Riparia 420A	15																																																					
Vitis Berlandieri x Rupestris 1202	16																																																					
Vitis Berlandieri x Rupestris 1203	17																																																					
Vitis Berlandieri x Rupestris 1613	18																																																					
Vitis Berlandieri x Rupestris 1616	19																																																					
Vitis Berlandieri x Rupestris 3306	20																																																					
Vitis Berlandieri x Rupestris 3309	21																																																					
Vitis Berlandieri x Rupestris St. George	22																																																					
Vitis Berlandieri x Vitis Rupestris Martin	23																																																					
Vitis Berlandieri x Vitis Rupestris Metallica	24																																																					
Vitis Berlandieri x Vitis Rupestris St. George	25																																																					
Vitis Berlandieri x Vitis Riparia 420A	26																																																					
Vitis Berlandieri x Vitis Riparia 1613	27																																																					
Vitis Berlandieri x Vitis Riparia 1616	28																																																					
Vitis Berlandieri x Vitis Riparia 3306	29																																																					
Vitis Berlandieri x Vitis Riparia 3309	30																																																					
Vitis Berlandieri x Vitis Riparia St. George	31																																																					
Vitis Berlandieri x Vitis Vinifera Cabernet Sauvignon	32																																																					
Vitis Berlandieri x Vitis Vinifera Chasselas	33																																																					
Vitis Berlandieri x Vitis Vinifera Grenache	34																																																					
Vitis Berlandieri x Vitis Vinifera Mission	35																																																					
Vitis Berlandieri x Vitis Vinifera Pinot Noir	36																																																					
Vitis Berlandieri x Vitis Vinifera Riesling	37																																																					
Vitis Berlandieri x Vitis Vinifera Sauvignon Blanc	38																																																					
Vitis Berlandieri x Vitis Vinifera Semillon	39																																																					
Vitis Berlandieri x Vitis Vinifera Zinfandel	40																																																					
Vitis Rupestris x Vitis Vinifera Cabernet Sauvignon	41																																																					
Vitis Rupestris x Vitis Vinifera Chasselas	42																																																					
Vitis Rupestris x Vitis Vinifera Grenache	43																																																					
Vitis Rupestris x Vitis Vinifera Mission	44																																																					
Vitis Rupestris x Vitis Vinifera Pinot Noir	45																																																					
Vitis Rupestris x Vitis Vinifera Riesling	46																																																					
Vitis Rupestris x Vitis Vinifera Sauvignon Blanc	47																																																					
Vitis Rupestris x Vitis Vinifera Semillon	48																																																					
Vitis Rupestris x Vitis Vinifera Zinfandel	49																																																					
Vitis Vinifera Cabernet Sauvignon	50																																																					
Vitis Vinifera Chasselas	51																																																					
Vitis Vinifera Grenache	52																																																					
Vitis Vinifera Mission	53																																																					
Vitis Vinifera Pinot Noir	54																																																				
Vitis Vinifera Riesling	55																																																				
Vitis Vinifera Sauvignon Blanc	56																																																			
Vitis Vinifera Semillon	57																																																			
Vitis Vinifera Zinfandel	58																																																		

TABLE 7.—*Relative behavior and value for different purposes of grape direct producers originated in Europe and in the United States growing on their own roots in 12 experimental vineyards in California*—Continued

Variety and parentage	[illegible]	Period planted (years)	[illegible]	[illegible]	[illegible]	Growth starting date		Blossoming date		Fruit setting date		Fruit ripening date		[illegible]	[illegible]	[illegible]	[illegible]	Cluster			Berry			[illegible]
						Early season	Late season	Early season	Late season	Early season	Late season	Early season	Late season					Size	Shape	Compactness of bunch	Size	Shape	Color	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Seibel, No. 1000 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seibel, No. [illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Seibel, No. [illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seibel, No. [illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seibel, No. [illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shalal (La × Ru × La)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Do.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
She by (La × R)	C	8	40+	[illegible]	2-6	Mar. 8	Apr. 8	Apr. 18	May 12	Apr. 30	May 16			[illegible]	[illegible]			[illegible]	1	mc	am	r	w	jw
Tonkawa (La × V. × Bu)	C	9	88+	[illegible]	2-8	Mar. 19	Apr. 1	Apr. 28	do.	May 2	May 17			[illegible]	[illegible]			[illegible]	l	l	m	o	r	tjw

Triumph:																								
La.×V	C	9	95+	cs	2-6	Mar. 18	Apr. 6	May 1	May 18	May 5	May 22	....	....	m	r	....	....	s	ltc	m	ml	o	w	ts|w
Do	O	6	88−	s	1-6	Mar. 14	Apr. 12	May 26	June 1	May 29	June 2	....	....	m	r	....	....	s	ltc	m	ml	o	w	ts|w
Ulster:																								
La.×V	C	8	90+	s	2-6	Mar. 15	Apr. 6	Apr. 20	May 2	Apr. 24	May 6	....	....	m	o	....	....	m	ct	mc	m	sc	r	t|w
Valhallah:																								
(La.×V.×Ba.)×(C.×R.)	C	14	80+	s	2-8	Mar. 22	Apr. 18	Apr. 30	May 20			....	....	g	r	....	....	m	c	c	m	r	b	|wt
Do	O	17	65−	s	1-6	Mar. 13	Apr. 12	Mar. 30	May 29	May 9	June 1	....	....	g	r	....	.7650	m	c	c	m	r	b	|wt
Do	Cx	3	80−	s	2-8	Mar. 25	Apr. 20	May 15	June 12	May 20	June 15	Sept. 25	Oct. 15	g	r	....	....	m	c	c	m	r	b	|wt
Do	F	17	82	s	2-6	Mar. 10	Mar. 29	Apr. 24	May 28	Apr. 27	May 14	Sept. 8	Sept. 20	g	r	....	.4750	m	c	c	m	r	b	|wt
Vergennes:																								
La.	C	8	82+	s	2-6	Mar. 20	Apr. 4	May 2	May 16	May 6	May 20	....	....	g	r	....	....	m	ct	mc	ml	or	r	ts|w
Wapanuka:																								
(La.×R.×V.)×(La.×V.×Ba.)	C	7	10−	c	....	do	Apr. 10	....	....	....	....	....	....	g	r	....	....	s	ct	c	l	r	w	ts|wc
Wheaton:																								
La.×Ba.×V	C	6	20	s	....	do	Apr. 8	....	....	....	....	....	....	p	o	....	....	sm	c	mc	s	r	w	|w
Wilder:																								
La.×V	C	8	92	cs	2-8	Mar. 17	Apr. 4	Apr. 30	May 25	May 3	May 29	....	....	p	r	....	....	m	t	l	l	o	b	ts|wc
Winchell:																								
(La.×V.)×A	G	5	30+	c	....	Mar. 16	Apr. 30	....	....	....	....	....	....	e	r	....	....	m	t	mc	m	r	w	t|w
Do	O	6	70+	s	1-6	do	Apr. 6	May 21	May 27	May 24	May 30	Oct. 12	Oct. 20	e	r	....	....	m	t	mc	m	r	w	t|w
Do	S	6	90+	s	....	do	May 2	....	....	....	....	....	....	e	r	....	....	m	t	mc	m	r	w	t|w
Wine King:																								
(A.×La.)×(Li.×Ru.)	C	13	98−	s	3-8	Mar. 21	Apr. 6	Apr. 30	May 20	May 2	May 23	....	....	m	r	....	....	l	c	c	m	r	b	|w
Do	O	17	89−	s	2-7	Mar. 13	Apr. 12	May 24	June 1	May 28	June 3	Sept. 14	Oct. 4	m	r	24	1.181	l	c	c	m	?	b	|w
Woodruff:																								
La.×V	C	8	50+	s	2-6	Mar. 16	Apr. 10	May 2	May 5	May 5	May 6	....	....	m	r	....	....	m	rt	mc	ml	ro	r	ts|w
Worden:																								
La.	C	14	10−	s	2-4	Mar. 23	Apr. 28	Apr. 9	May 8	do	May 11	....	....	g	r	....	....	m	c	l	m	r	b	t|w
Do	Cx	14	85+	s	2-8	Mar. 29	Apr. 27	May 16	June 17	May 10	June 29	Sept. 26	Oct. 4	g	r	26	.5812	m	c	l	m	r	b	t|w
Do	O	15	82+	s	2-8	Mar. 19	Apr. 12	May 2	June 8	May 5	June 12	Oct. 2	Oct. 18	g	r	....	....	m	c	l	m	r	b	t|w
Do	O	15	14−	s	2-4	Mar. 10	do	May 22	May 24	May 25	May 26	....	....	g	r	....	....	m	c	l	m	r	b	t|w
Wyandotte:																								
Li.	C	6	88+	s	....	Mar. 19	Apr. 10	....	....	....	....	....	....	o	r	....	....	m	t	mc	m	r	w	t|w
Wyoming:																								
La.	C	14	40−	s	3-6	Mar. 17	Apr. 18	Apr. 23	May 12	May 1	May 17	....	....	m	r	....	....	m	c	l	m	r	r	ts|
Do	O	15	82−	s	2-9	Mar. 19	Apr. 12	May 6	May 24	May 9	May 28	Sept. 15	Sept. 24	m	r	....	....	m	c	l	m	r	r	ts|
Do	O	15	56−	s	2-6	Mar. 13	Apr. 15	May 21	June 1	May 25	June 4	Oct. 3	Oct. 8	m	r	24	.5100	m	c	l	m	r	r	ts|
Do	S	15	60−	s	3-6	Mar. 17	May 19	do	do	May 24	June 5	....	....	m	r	....	....	m	c	l	m	r	r	ts|
Xinta:																								
(V.×La.)×(Li.×Ru.)	C	13	85+	s	2-8	Mar. 15	Apr. 4	May 2	May 20	May 1	May 27	....	....	m	r	....	....	l	c	m	m	r	b	|w
Do	P	16	60	s	3-6	Mar. 9	Mar. 30	Apr. 24	May 15	Apr. 27	May 19	Sept. 3	Sept. 6	m	r	21	.4200	l	c	m	m	r	b	|w
Do	O	17	70−	s	2-7	Mar. 19	Apr. 16	May 29	June 4	June 1	June 8	Sept. 19	Oct. 5	m	r	24	.9812	l	c	m	m	r	b	|w

SUMMARY AND CONCLUSIONS

Information relative to the successful use of the different phylloxera-resistant grape stock varieties best suited to various soil, climatic, and other conditions, as well as for the successful establishment of vineyards on resistant stock, is given in this bulletin. It also contains information relative to the so-called direct producers originated in Europe, together with those originated in the United States, that have been tested in the United States Department of Agriculture experiment vineyards located in the various vinifera regions.

The ideal resistant stock is one having a most resistant root which is congenial to a top producing an abundance of best-quality fruit.

Varying soil, climatic, and other conditions complicate the establishment of vineyards on resistant stocks.

Good resistant vineyards can result only when stocks are grafted with vinifera varieties congenial to them and grown in soil and under climatic and other conditions to which they are suited.[9]

The adaptability of resistant stocks to soil, climatic, and other conditions can be closely forecast, but their congeniality to varieties grafted on them must be determined by actual test.

Where conditions are not suited to any given species they are often adapted to hybrids of a species with some other species; and where all the qualities desired can not be found in a hybrid, a complex hybrid (a hybrid of hybrids) may yield the desired results.

The congeniality of the variety to the stock on which it is grafted very materially affects the phylloxera-resistant quality of the stock.

The relative rooting quality of resistant cuttings is an important consideration in the cost of establishing a resistant vineyard.

Cuttings of many of the hybrids root easily, although the cuttings from one of the parents may be hard to root.

Stocks that root easily from cuttings may not give good results in bench grafting.

Some stocks are especially suited for bench grafting, whereas others are suitable only for vineyard grafting.

Some of the hybrid resistant-stock varieties are resistant stocks in California under conditions suited to them.

Resistant stocks giving excellent results as entire plants may be failures as graft bearers.

Species difficult to propagate otherwise can be readily grown from seed, but seedlings vary greatly and for this reason are undesirable for vineyard purpose.

Cuttings of monticola, berlandieri, aestivalis, linsecomii, bicolor, and candicans rooting with difficulty should be grown by layering or rooted in the nursery and either grafted there or planted in the vineyard and subsequently grafted.

Riparia cuttings root easily and are excellent stocks well suited for vineyard and bench grafting, but in California they are adapted only to locations where they are influenced by the sea and coast to a marked degree. Soils in which riparia varieties thrive usually produce

[9] In the department's experiment vineyards at Fresno and Oakville, Calif., are mother-vine plantings of all the important phylloxera-resistant stock varieties considered valuable in establishing vinifera vineyards on resistant stocks. Growers will be able to obtain a limited supply of cuttings of such varieties as are not procurable in nurseries of this country by making a direct request for them sufficiently early in the winter for the cuttings to be prepared in time for spring use.

large crops of fruit which ripens relatively early and is of only fair quality.

Rupestris stands drought well, its cuttings root and graft easily, and it is best adapted for bench grafting, but when so used the dormant eyes should be cut out of the stocks. Many grape varieties are not congenial to rupestris and usually ripen their fruit somewhat later on it than when grown on other stocks.

A grower intending to establish a vineyard on resistant stocks should decide on the vinifera varieties he intends to grow and then choose soil and other conditions suited for the object in view. It should be previously determined whether the plantings are to be bench or nursery grafts or stocks planted in the vineyard and grafted afterwards, and resistant varieties congenial to the variety to be grown should then be selected. Familiarity with all the operations required in establishing a resistant vineyard is most essential.

The more promising of the direct producers introduced and tested in the department's experiment vineyards showed no complete successes. Either the hybrids reverted too far toward the vinifera and the phylloxera-resistant qualities were found wanting, or too much toward the resistant, thus impairing the quality of the fruit; or both resistance to phylloxera and the quantity and quality of the fruit of the hybrid were not as desired. So far none of them are equal to some of the finer American grape-juice varieties that are improved varieties or hybrids of native species.

Information relative to grape propagation and grafting is to be had in Farmers' Bulletin No. 471.[10] Information relative to vinifera grape varieties and their congeniality to important resistant stocks can be had in Department of Agriculture Bulletin No. 209.[11]

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[10] HUSMANN, G. C. GRAPE PROPAGATION, PRUNING, AND TRAINING. U. S. Dept. Agr. Farmers' Bul. 471, 29 p., illus. 1911.

[11] HUSMANN, G. C. 1915. Op. cit.

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January 23, 1930

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U. S. GOVERNMENT PRINTING OFFICE: 1930